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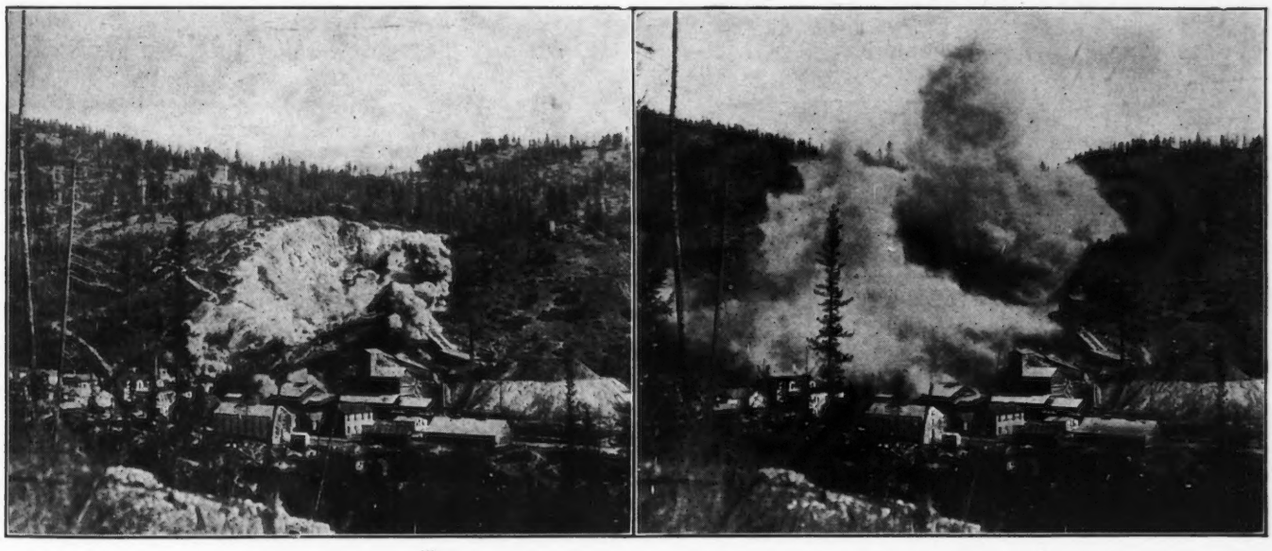
The Mother Lode Blast

By F. S. Norcross, Jr.*

SYNOPSIS—Mining large blocks of ground, 150 to 250 ft. deep, 200 ft. long, from foot to hanging at one blast. Drilling, loading and shooting the largest blast on record for underground mining; 100,000 sticks of dynamite required; 400,000 tons of rock broken. No galvanometer used to test circuit. Ground blasted was drilled to within 30 ft. of corner of shaft; buildings and plant all within radius of from 25 to 200 yd. of blast. No accidents and no damage; operation a complete success.

On Labor Day, 1913, an electric blast was set off at the British Columbia Copper Co.'s Mother Lode mine, Greenwood, B. C., which to the best of my knowledge was a world's record for a strictly underground blast, not only in the amount of powder used but also in the amount of ground broken, number of holes exploded, and wire used, which were as follows: Number of holes, 4830; number of detonators, 5040; depth of holes, 15 ft.; dynamite, 40%, 49,550 lb.; wire, 18.5 miles; estimated amount broken, 400,000 tons.



The Great Blast at the Mother Lode Mine, British Columbia

At the instant of blast, showing first smoke-shoots from tunnels, shaft-collar, glory-hole, etc., and 30 sec. after blast

Mining System

This system of mining is rather unusual, but existing conditions left no alternative. The Mother Lode deposit is a pear-shaped lens, 1100 ft. long, 260 ft. wide, and 500 ft. deep, with the long axis horizontal. Owing to the different methods of mining employed at different periods, the mine became a honeycomb in structure, making further stoping impossible. Moreover, as the best ore had been removed, further progress depended on a method which was safe and which guaranteed low cost—obviously a caving system of some sort. As the ground is hard and tough, the caving system to be used must also provide for a well-broken product, as only the upper portion of each blasted section would be accessible for block-holing. To meet these conditions the system of blasting large blocks or slices of ground was resorted to.

These so-called blocks were usually 200-ft. sections along the strike of the orebody, extended from foot wall to hanging, and were from 150 to 250 ft. in depth. Each block was thoroughly drilled, and those portions not thoroughly honeycombed by stoping were cut up by a series of parallel raises 30 ft. apart. In many cases three or four raises were placed one above the other on the same vertical plane. All the raises on any one plane were connected by back-raises, making an inverted V.

In the old stoped-out portions all the accessible wall and pillars were drilled, but wherever the raise system of opening up had been used, only alternate raises were drilled, a complete circle of holes being placed every 4 ft. throughout its length. When near the wall rock the back

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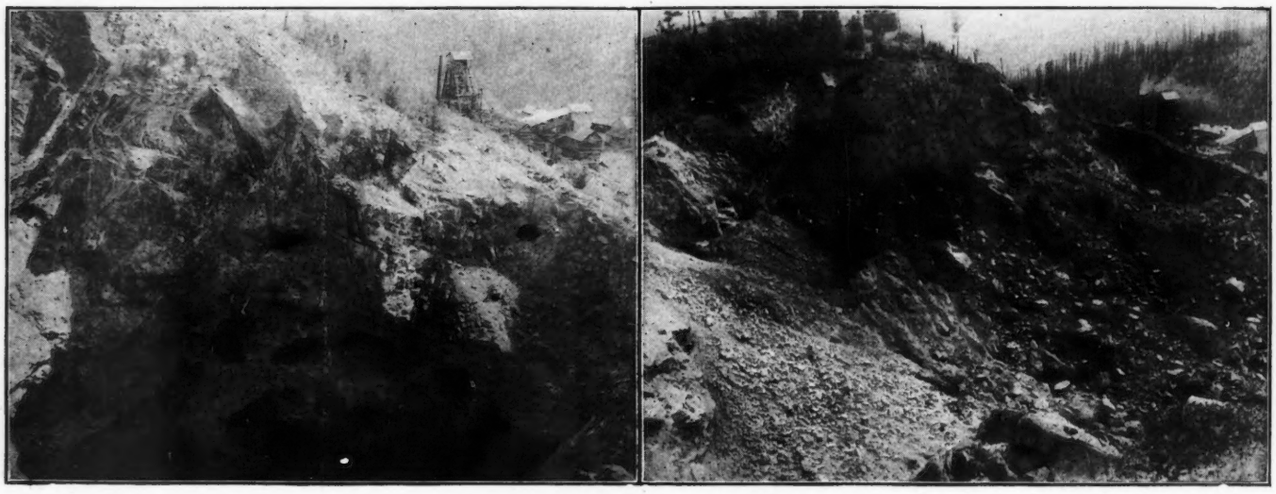
of every top raise was drilled in order to insure a clean break, and the same method was followed in the footwall raises. Sullivan and Rand 3¼-in. piston drills were used, the holes being 15 ft. deep, except in thin walls. In a few cases 18-ft. holes were drilled.

In the early application of this method, under Superintendent E. Hibbert, the blocks blasted were comparatively small and contained only 100 to 600 holes, and one of 2000 holes; but as the country surrounding the shaft was approached they became larger and more complicated. In this particular blast a feature which caused great anxiety was the proximity of the main hoist to the blast. The hoist sets out over the workings, as the good ore under it had been partly stoped out in the earlier days, leaving short pillars to support it. To avoid a "drag" on this ground due to any caving subsequent to the blast, "cut-off" raises were run up and apexed 30 ft. from the corner of the hoist and drilled up on the side away from it. This brought the blast closer, but insured a clean break and left a straight supporting wall free of weight.

This blast was the largest ever employed here, for several reasons: (a) The included stopes were larger; (b) the hanging wall was sure to fall at the next explosion; therefore, to have cut the blast in two would have meant the loss of whatever ore remained standing; (c) last, but not least, the ground in question was composed of two dissimilar ores, one portion was a self-fluxing lime-silicate; the other a heavy magnetite, containing from 25 to 40% iron. As the company's smeltery operated on a basis of self-fluxing ores, a mixture of these two grades of ore was economically essential.



BEFORE THE BLAST AND AFTER

To provide for the handling of the broken rock, passages or muck-runs were necessary. A series of these muck-runs or raises (approximately 10 ft. square) was laid out from the 200 level down to the 300 and 400 levels. As this blasted country lay over the 200 level, this arrangement permitted simultaneous tramming on three different levels. Side connections or "bulldozing chutes and manways" tapped the upper side of these muck-runs to allow trammer gangs to blockhole and bulldoze large rocks before they reached the chutes.

PREPARATION PRIOR TO LOADING

Six days were allowed for loading and wiring. Owing to the smeltery needs, only one day's shutdown was permissible, so Labor Day was selected for the day of blast.

Before any powder entered the mine and a few days before the drilling was completed, the following details were covered: (1) Detailed plans and notes of the wiring system were drawn up and the electrician made thoroughly familiar with every detail, both of the wiring plans and of the mine workings. (2) Sprags were placed and all the main lead wires strung. The smaller sub-branches were also measured and connected at the same time, and then coiled up on the various poles until holes were ready to connect. (3) Any openings connecting portions of the mine on different leads (six in all) were fenced up, leaving only two passageways to each. (4) Temporary tracks and board chutes were placed for handling powder to the main distributing points. As approximately 100,000 sticks of dynamite were to be handled, any delay would have been serious. (5) Two sprags were connected by one cross-piece, sets being not more than 14 ft. apart, placed at all loading points. The loaders could then slide a single plank from bar to bar in level places to load back holes, and in sharp inclines one end of a plank was placed on the ground. (6) Safety fences and hand ropes were placed above and adjacent to all big stopes, breakthroughs, muck-runs, etc.

EXPLOSIVES

The powder used was 40% dynamite, furnished by the Giant Powder Co. It was not thought necessary to use the non-freezing explosives, as the mine was free of ice and water at this time of the year. A previous blast set off in April of the same year contained 1800 holes, 70% of which were full of ice, and had to be thawed out with steampipes before loading, after which they again froze solid. As this blast was a complete success, no trouble from wet or frozen holes was anticipated. The use of 60% dynamite would have insured a better broken product and, through sympathetic detonation, might have remedied any small circuit break, but was not used, however, as missed holes would have been a constant source of danger to crushermen, also to miners blockholing or plugging the larger rocks in subsequent operations.

A hammer drill actually penetrated a missed hole left from a previous blast containing 40% dynamite without exploding it.

The wire used ranged in size from No. 1 to No. 22, and was waterproof. The detonators used were Nobel's No. 7 low-tension caps carrying 95% fulminate of mercury and 5% chlorate of potash.

Loading

Foreman, shiftbosses and electrician were provided with lists of places, the order in which they were to be loaded and when the various bulkheads (to break air blasts in shaft country) were to be placed. Work was begun on Tuesday night.

Three men made primers inserting the detonator, scraping the fuse-wire ends and coiling wires around sticks of powder ready for delivery. These primers all had the detonator stuck straight into the end, no bend or double puncture being used (see Fig. 1).

Six men packed powder in boxes with top loose, and 26 to 30 men per shift loaded holes. Loaders worked day and night shifts for 4½ days, finishing Saturday at midnight.

Loading was begun in the topmost portion of drilled ground nearest the shaft, and worked downward and away from the shaft to the point of exit on the 200 level. This avoided any chance of falling powder, rock-slides, etc., on those below, and possible broken connections in wire circuits.

Loaders worked in pairs; each hole was well packed, but no tamping was used. The primer was the last stick

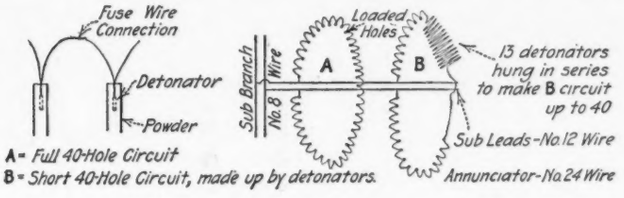


Fig. 1. Method of Inserting and Connecting Detonators

put in the hole, and the fuse wires were hung in loose coils ready for the wiremen. In bench and floor holes the wires were uncoiled from around the primer and coiled in the top of the hole or on a small stick in easy reach of the electricians.

Headache tablets and fresh washing water were constantly kept on hand, as the men suffered severely from powder-headache. Only one man, working without gloves, was able to go through without losing time

Wiring

The wiring gang was composed of a head electrician and six helpers. Loaders were given one day's start before wiremen began work. The wiremen worked in pairs and on day shifts only. The sub-branches previously prepared were strung out and nailed to end sprags, and the holes connected in series of 40 across these branches. No. 22 annunciator wire was used in case of distant holes. All main leads and subs had their ends nailed to sprags, and the overhang was cut short to avoid possibility of someone connecting them, thereby causing a short and possible cutouts in the individual series.

No insulation tape was used on the fuse-wire connections between detonators; time required made it prohibitive. Instead, care was taken to bend such connections away from the ground. All the main-lead and sub-branch connections, however, were carefully insulated.

When less than 40 holes were available, a sufficient number of detonators were connected in the series (see Fig. 1), in order to keep the resistance of each series equal. As each place was completed, a gate was placed across the entry and hung with a sign marked *Keep Out,* to avoid any reëntry by workers.

No galvanometer tests were made of the circuits because of both disinclination and lack of time. For this reason particular care was exercised in keeping away from all completed sections and in double-checking each circuit by the two men working on it. Of course, a defective detonator or fuse would not be discovered. A proportion of the detonators were tested before using. If this had been an initial blast, and more or less of an experiment, it would have been wise to have had all detonators tested or sent from the factory under a special guarantee; but in previous blasts they had given such satisfaction that no trouble was anticipated.

Many engineers have questioned the policy of not using galvanometer tests, as practiced elsewhere. In the first place, there is no comparison to be made with other practice, which almost invariably consists of one set of lead wires with a single series across them, thus making it possible to test the connections through the leads near the switch. With us such tests meant the trial of 126 circuits to be made within 10 ft. of the holes, the possibility of a short through only one detonator instead of 40, and the necessity of walking through or over the small circuits after testing, thus bending connections to ground or breaking them.

Wiring was completed Sunday afternoon. All entries to the mine were blocked, skips and cage removed from shaft, top three lengths of ladders removed, and watchmen placed. Connections (see Fig. 2) now stood as follows: Open switch main line to transformers; open switch transformer side to main No. 1 lead down shaft; broken screw connection main lead to branch on 60 level, from which B, C, D, E branches run; broken screw connection main lead to branch F on 200 level.

To explode it was necessary to make three screw connections and close two switches, progressing from 200 level up through the shaft by transformers to the main-line switch.

The only real danger of the six days occurred during a short electric storm the same night (Sunday), several wires, including the main lead wires, being exposed in places.

Explosion

Notices posted at 6 o'clock Sunday night gave to all residents in the camp full details of the procedure to be followed, such as removing windows, putting out fires, wedging all doors open, etc., warning whistle and final blasting signal. All were ordered to leave the hill by 8 a.m. Monday. The three roads leading to the camp were blocked. Only three men remained at the mine during the explosion. As the mine buildings and houses were all within a 25- to 200-yd. radius, these precautions were necessary.

The blast was set off at 9 a.m. Monday, as previously planned, and was a complete success. No missed holes have been found. A few holes in the foot wall, which had been overlooked and never connected, were found unexploded, which fact, by the way, verifies our theory

that the 40% dynamite is not subject to sympathetic detonation.

Electrical Discussion

Two things were to be determined—plan of wiring and number of holes in a series.

The plan of wiring was one of "parallel series," 40 holes being connected in series across the branch leads, and these 40-hole series being in parallel with each other. This method gives low resistance. Two important factors were influenced by the number of holes connected in series: (a) The fewer the number of holes per series, the more series circuits in parallel; therefore, less resistance and more current necessary. (b) Failure of one detonator to explode due to a defective detonator or a single poor connection may prevent explosion of this particular series; for this reason it was not expedient to place too many holes in series.

Past experience has verified the fact that 40% dynamite is not usually subject to sympathetic detonation, so this could not be depended upon to counteract the irregularities mentioned.

A previous blast of 2400 holes successfully exploded was wired in 25-hole series. Using this as a basis, 40-hole series were chosen for the larger blast.

Owing to the irregularity of the ground and the position of the holes, it was impossible to lay out a system where the various branches would bear equal loads and also permit safe and rapid connection. However, branches were made as nearly equal as possible.

Current and Voltage

On an instantaneous blast of this character a very sensitive recording instrument to register current, etc., would be necessary. Not having such an instrument available makes it necessary to use partial experimental data to determine probable current and voltage required.

The detonators used were Nobel's No. 7 low-tension exploders. By test these give a resistance, including 8-ft. wire fuse leads, of 1.25 to 1.50 ohms each. This resistance is more or less variable and depends on the length, etc., of the bridge connecting the two lead wires in the detonator, as this bridge must be raised to sufficient temperature to convey heat to the flashing composition. While many caps have bridges which take the same time, others are measurably slower or quicker. In order, therefore, to overcome these variations sufficient current has to pass through a series to bring the most refractory bridge to the required temperature before the most sensitive bridge has fused; hence, there will be a proportionate increase in the current required as detonators are added to the series.

For this reason, while it takes from 0.5 to 0.7 amp. only per detonator, it requires, by experiment, 1.1 amp. for 2 in series; 1.2 amp. for 10 in series; 1.5 amp. for 20 in series, and 2.75 amp. for 40 in series.

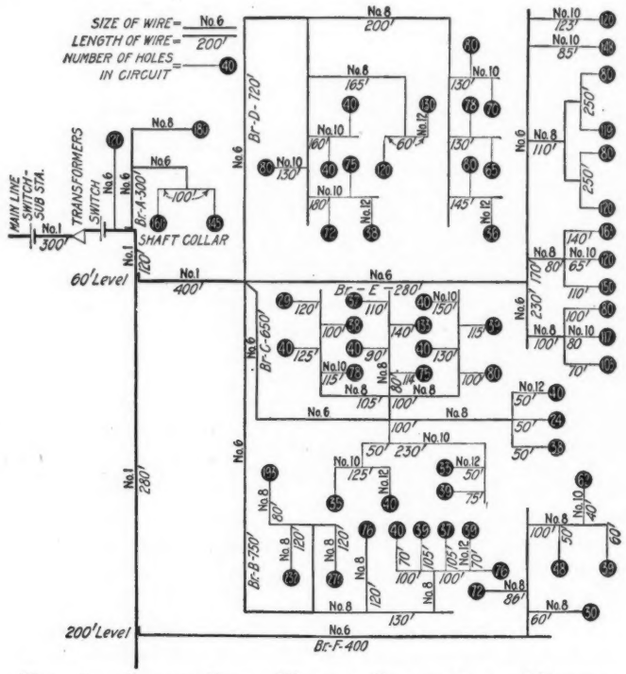
As it is proposed to fire 5040 detonators in series of 40, there will be 126 parallel circuits each requiring 2.75 amp. In order, therefore, to fire the whole simultaneously, 346.5 amp. would be necessary.

The resistance of each series being 60 ohms (by test), it would then require 165 volts to pass the current of 2.75 amp. through each series. We add 10 volts to cover line drop, etc. It is therefore evident that in this blast there will be ample current available, as its quantity is measured by $\frac{E}{R} = \frac{550}{0.52}$, or practically 1100 amp.

In the discussion following, however, it is assumed that only the current and voltage quantities (as per experimental data given in the foregoing) are available, and it is then shown that if limited to these amounts there might have been trouble unless conditions were ideal. As the resistance is the factor which will change the quantities of current and voltage, any increase in its value would, on the above-cited assumption, exceed the available power; therefore the effort to keep the series resistances equal. Hence excess power becomes the safety factor in the problem. It might be added here that the latter statement is contrary to the advice of the big powder companies.

Resistance

Inasmuch as the system consisted of 126 circuits in parallel, it is evident that the total resistance of the blast will be very small, even though the amount of wire used


SIZE OF WIRE= No 6
LENGTH OF WIRE= 200'
NUMBER OF HOLES IN CIRCUIT= 40
MAIN LINE SWITCH-SUB STA.
TRANSFORMERS
SWITCH
SHAFT COLLAR
60' Level
200' Level
Br-D-720'
Br-A-300'
Br-E-280'
Br-C-650'
Br-B-350'
Br-F-400
No 1 300'
No 1 120'
No 1 400'
No 1 280'
No 6 200'
No 8 200'
No 10 123'
No 10 85'
No 8 165'
No 10 130'
No 10 160'
No 12 60'
No 10 130'
No 10 80'
No 12 145'
No 12 50'
No 8 110'
No 6 250'
No 6 250'
No 8 80'
No 10 65'
No 6 230'
No 8 100'
No 10 80'
No 8 105'
No 8 100'
No 6 100'
No 8 100'
No 10 230'
No 10 125'
No 12 50'
No 12 75'
No 8 80'
No 8 120'
No 8 120'
No 8 105'
No 8 70'
No 8 100'
No 8 80'
No 8 130'
No 8 100'
No 8 50'
No 8 60'
No 10 40'
No 6 100'
No 6 130'
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No 6 100

therefore the three 40-hole series would take 8.25 amp., a total of 15.55 amp. As there are only 13.75 amp. available, each series would get proportionately less—the 40-series something less than 2.75 and the 30-series less than 3.66 each. Thus cut-outs would possibly occur in the 40-hole series.

To provide for such possible inequalities in the 126 series a surplus of power was necessary, and for this reason the current was taken from a main power line through three delta-connected 2200-volt-550-volt 50-kw. transformers.

Theory vs. Practice

According to test on single detonators the current necessary was 0.5 amp.; resistance, 1.50 ohms; voltage (current × resistance), 0.75 volt.

Therefore to explode 40 in series we would have, by Ohm's law, a resistance of 50 to 60 ohms to overcome, with a current of 0.5 amp. necessary per series. By actual tests, however, the current per series is found to range from 2 to 2.75 amp. and the resistance to be 60 ohms. Using these experimental values, voltage was determined for the 126 series to be 165 volts, and the current necessary, 346.5 amp. These figures neglect wire resistance and line loss.

The resistance of the blast, with wire included, is 0.52 ohm, computed on the basis of 60 ohms per series. Using this resistance factor and the experimental current value there was as a check the following voltage, which should cover everything, as the resistance used is assumed to be the blast total:

$$E = IR = 346.5 \times 0.52 = 180.2 \text{ volts}$$

To sum up, there were the following data:

Theoretically—For one series: Current necessary, 0.5 amp.; voltage necessary, 30.0 volts; resistance, 60.0 ohms. For 126 series: Current necessary, 63.0 amp.; voltage necessary, 30.0 volts; resistance, 0.476 ohm.

Experimentally—For one series: Current necessary, 2.75 amp.; voltage necessary, 165 volts; resistance, 60.0 ohms. For 126 series: Current necessary, 346.5 amp.; voltage necessary, 165 volts; resistance, 0.476 ohm. For entire blast: Current necessary, 346.5 amp.; voltage, 180.2 volts; resistance, including wire, etc., 0.52 ohm.

Remarks

The experimental data for the entire blast as given above were accepted as final. With the excessive transformer capacity, extra-size wires and current from the main power line of high voltage we had a safety factor to offset unequal resistance, line loss, ground leakage and other possible discrepancies. The blast might have been fired from a line of much less power, but with so much at stake there was nothing to gain and a great deal to lose. Too little power, which must trust to overload capacities, or just enough, which must depend on ideal conditions, might both be successful, but dangerous. An excess of power is imperative and is not a drawback provided the wires will carry.

The mine electrician, A. Davison, deserves great credit for the thorough manner in which the wiring was carried out; also the shift-bosses and miners, who by their interest and loyalty completed a painful and dangerous task and made the blast a success.

Tantalum Apparatus Is Entirely Out of the Market, it is understood, owing to the cutting off of shipments from Germany. This disposes of one suggested substitute for platinum.

Mr. Hoover, the Rescue Specialist

Under the above caption our gay and discerning contemporary *Life* published an article about H. C. Hoover, showing that the non-professional press is beginning to appreciate Mr. Hoover's merits and achievements. *Life's* article was as follows, except for a few misstatements of fact that we have taken the liberty to correct and the excellent picture of Mr. Hoover that we have added:

The London "Nation" declares that "Mr. Hoover's American commission for the feeding of the starving Belgians" has done a "miracle of diplomacy" in obtaining and distributing its supplies. Brand Whitlock and a good many others have shared in that miracle and will come in if there should be some time an adjustment of credit.

There seem to have been extraordinarily good American men on this job of feeding the Belgians. That the Rockefeller Foundation's men should be intelligent and efficient was to be expected, but that a man with such a spirit inside of him and such a human experience as Mr. Whitlock should have

Herbert Clark Hoover

been appointed Minister to Belgium was a wonderful piece of luck, or perhaps a political Providence.

And as for Mr. Hoover, how did he happen? When the war suddenly exploded one began to read of the activities in London of an American named Hoover, a business man full of business, and considerably full of money, who got right in and took hold of the work of salvaging distressed tourists, finding money for them, and getting them home. It has not been possible since that time to intrude far into salvage activities without running into this Mr. Hoover. His performance has been like that of a man in a play who transpires, say, from L. U. E. at the critical moment and straightens out the situation that was as good as lost. Mr. Hoover, however, seems to belong to real life. One reads from "Who's Who" that he's an engineer, mining and assorted, 40 years old, born in Iowa, a graduate (and trustee) of Leland Stanford University, a resident of London, with offices in New York and San Francisco, a director of a line of mining companies, which operate in many parts of the world, and a member of numerous engineering societies in America, England, France and Belgium.

Mr. Hoover, it would seem, will emerge from the war with a large advertisement as a handy man in social service. That is a serious prospect for a mining specialist only 40 years old. People who are known to be efficiently helpful

in the work of looking after other folks are liable to be drafted for that employment.

The New York *Evening Post* contributes the following editorial appreciation:

The story of how the Belgian Commission has supported a people requiring $65,000,000 in food supplies with but $10,000,000 in foreign contributions does equal credit to the financial resourcefulness of Mr. Hoover and his associates and to the recuperative power of the small kingdom. The English press has consistently asserted that it is not the generosity of Americans for which Belgium should be most grateful, but the commission's organizing genius. The dispatches show how huge was its problem. It was necessary to utilize the credit of a population deprived of all metallic and almost all paper currency; to do a systematic banking business across enemy lines—remaining the only institution carrying one on; and it had so to organize its charity that the destitute in Belgium should be aided by their own countrymen. Its direct efficiency is attested by the fact that by careful purchases, the chartering of ships, and the substitution of volunteer effort for middlemen it has kept the price of bread in Belgium below that in London, and yet made $6,000,000 profit on its sales. The scope of its work is shown by the dependence of the communes upon it for money to pay their officers, teachers, and social agents, and to keep up their normal activities. This country has had reason to be proud of the initiative and ability of its ambassadors, ministers, and consuls in solving the problems thrust upon them by the war; in the Belgian Commission it has been served by a display of American practical resourcefulness fully as great.

Copper Operations at Katanga

P. K. Horner, manager of the Union Minière du Haut Katanga, who is visiting some of the important copper mines in the United States, stated that his company is producing copper at the rate of from 1000 to 1200 metric tons per month. The company is smelting oxidized ores averaging above 15% Cu and makes a high-grade black copper running about 96% Cu. Two 48x192-in. Allis-Chalmers furnaces are being run continuously, and occasionally a third furnace, which was completed about the middle of 1914. An addition of four 42x240-in. furnaces was under order and practically ready to ship at the outbreak of the war, but as the complete program is impracticable, under the present conditions, the company is proceeding with the erection of two furnaces, which are from the Traylor Engineering & Manufacturing Co. It is expected that they will be in operation by the end of 1915. This should nearly double the present copper production. Last year the company's copper production amounted to about 10,700 metric tons, including 325 tons of 70% matte. The production of the current year is expected to exceed this materially, notwithstanding that some of the force have been taken for military service. At present about 200 whites and from 3000 to 4000 natives are employed at the property. Railroad connection has been established to the principal mines, and the monthly production of ore is from 8000 to 10,000 tons. The greater part of the ore comes from the Star of the Congo and the Kambove mines, a small amount being obtained from mines under development.

The company has erected an elaborate testing works, and extensive experiments are being carried out for the treatment of the lower-grade ores. The testing works comprise a concentration section and a leaching adjunct. The concentration section, the machinery for which was supplied by the Power & Mining Machinery Co., has a capacity of 150 tons per day. Archer E. Wheeler, consulting engineer, is now at the properties making an examination. The operating staff of the company comprises P. K. Horner, manager; Jules Cousin, assistant manager; Frank Kehew, smelter superintendent; Frank Moore, superintendent of the Star of the Congo mine; Mr. Johnson, superintendent of the Kambove mine, and M. Vandermaelen, chief chemist.

Surface Rights under Mining Leases

By A. L. H. Street*

A deed or lease for mining purposes implies right in the grantee to make such use of the surface as is reasonably necessary to secure enjoyment of the grant, according to the decision of the United States Circuit Court of Appeals, Eighth Circuit, lately announced in the case of Himrod vs. Ft. Pitt Mining & Milling Co., 220 *Federal Reporter* 80. "There are obvious degrees of necessity for the use of the surface in the conduct of subterranean mining operations," the court holds, "from the absolute necessity of sinking shafts or making other entrances to the minerals to the practical necessities of business operations, such as the placing of steam engines and machinery at the mouth of the entrances, of constructing ponds of water to supply the engines, of laying and operating rail- or tramways to bring in supplies and to carry out the ore, of storage of minerals on the surface pending sales, of assembling houses, stores and shops for the use of the miners; but such uses have been declared in the cases cited to be implied in the grants, if found to be necessary."

Covering the concrete question involved in the Himrod case, the Circuit Court of Appeals holds that grant of a right to bore a tunnel or to sink a shaft may imply the right, as a reasonable necessity, to use the surface for the deposit of waste and débris brought from the tunnel or shaft.

Allouez

The Allouez Mining Co., Calumet, Mich., for 1914 reports a profit of $114,530 from a production of 6,056,548 lb. of refined copper sold at 12.853c. per lb. Silver sales amounted to $13,402, making total receipts $791,821. Expenses for operations were $672,114 and interest payments, $5176. From 354,457 tons of ore stamped 9,408,470 lb. of mineral was obtained, which contained 64.37% of refined copper. The yield per ton of rock stamped was 17.09 lb. of copper. The cost of producing copper during the year was 11.18c. per lb. The following table gives a comparative record of the Allouez operations for the last four years:

	1911	1912	1913	1914
Tons of rock treated	288,610	333,618	236,663	354,457
Yield, lb. refined copper per ton of rock	16.56	16.56	17.29	17.09
Cost per lb. of copper (in cents):				
Mining, milling and transportation	10.07	9.74	9.76	9.26
Construction	0.90	1.60	0.16	.....
Smelting, freights, commissions, etc	1.95	1.87	1.94	1.83
Interest paid	0.38	0.31	0.23	0.09
Total cost per lb. of refined copper	13.30	13.52	12.09	11.18
Development work included in foregoing costs:				
Shafts	419 ft.	278 ft.	102 ft.	.....
Openings	7229 ft.	8517 ft.	4399 ft.	3526 ft.
Percentage of rock hoisted, discarded	2.049	1.868	1.269	0.484

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Recent Progress in Flotation

By O. C. Ralston and F. Cameron

SYNOPSIS—A review of the progress that has been made in the United States in the development of the process of concentrating ores by flotation. The work of many experimenters has been shrouded in secrecy by fear of litigation. However, without revealing confidences, some of this progress is now discussed from a purely technical point of view.

A review of recent work in flotation has proved practically impossible for the engineering journals to obtain on account of the peculiar existing conditions. Beyond a few isolated articles and occasional notes in the current news of the mining camps, little information on the subject of flotation is to be had. And yet there are between fifty and one hundred concentrating mills in this country operating or experimenting on a fairly large scale on the treatment of slimes from the mill circuit or on finely ground ores.

Prospect of Litigation Hinders Exchange of Ideas

As has been pointed out in the columns of the Journal, the cause of this silence lies in the litigation situation. Minerals Separation, Ltd., in trying to exploit processes for the concentration of ores by flotation based on numerous patents which it holds, found that it would have to sue those whom it considered infringers. Accordingly, suit was brought against James Hyde. Hyde had worked out a process for treating the zinc ores of the now famous Butte & Superior Copper Co., at Butte, Mont. The history of the case is well known. It has now reached the Supreme Court of the United States, where, in view of the crowded docket, it will probably not be considered for more than a year. Meantime the Minerals Separation company is suing the Miami Copper Co., of Miami, Ariz., in another of the district courts of the United States.

The condition with many millmen is this: The decision of the U. S. Circuit Court of Appeals in San Francisco was against Minerals Separation, and hence they feel that the paying of royalties or fees to this company before the consideration of the suit in the U. S. Supreme Court might be a waste of money. Meanwhile it is imperative that the valuable minerals in the slimes from their mills should be recovered, if possible. The larger companies have carried on serious investigations, and in most cases have obtained good results. However, publication of what they are doing is regarded as prejudicial to their interests, as it is hard to tell who may enter suit against them in the future for royalty payments.

If Minerals Separation wins its suit on the basic patent, most of these people are ready to pay up back royalties. If Minerals Separation should lose, many of them might still be liable to suit from other patentees of processes and ideas. Hence, a decision by the Supreme Court would not clear the situation immediately nor at an early date bring about a dissemination of literature on the subject. [We do not agree with this opinion.—Editor.]

This is regrettable, especially as a recent trip through part of the West by one of the authors has revealed the fact that, as a result of some excellent research work and experimentation which are going on, there is a healthy state of progress in this new field of metallurgical work. Much of the work that is being done will doubtless be kept secret for some time to come. Therefore in the following discussion of the subject we can only give out such information as will not betray the confidence of any of the operators interviewed. For that reason no localities, mills or companies are mentioned.

General Progress of Flotation Method

Certain progress in the more general details of flotation milling is of interest. For instance, it now looks as if much of the older concentrating machinery is going to be displaced by flotation machinery. The first application of flotation was to re-treat slimes carrying valuable sulphides, and it was hence merely an addition to slime-treating machinery, such as vanners and slime tables. Soon the vanner heads instead of the tails were being tested in the flotation machines, and the results have varied greatly. In some places the flotation machines are still treating the vanner or slime-table tails; in others the tests have shown better work with the older slime-treating machinery entirely eliminated. Of course, the criterion used has been the economy of concentrating the various ores in question.

Although slime-treating machinery could now be almost entirely dispensed with, there is still some doubt in many cases as to the advisability of doing so. However, some men have gone much farther and have suggested that it may be advisable to displace the sand-concentrating tables and to grind all material for direct treatment by flotation. In fact, one large copper company has decided to displace all concentrating machinery with the exception of rougher tables and regrind the tails from these for flotation. But with, say, a lead- or a zinc-sulphide ore containing the valuable minerals in large clean crystals it is hard to see why such a practice should be necessary. It would seem that only the fines and slimes, which are inevitably produced by any crushing, should require flotation treatment. This, of course, leaves out of consideration the cases where heavy gangue minerals make mechanical concentration of other kinds difficult. Considerable experimenting along these lines is now going on and it may be that this question will be settled by the end of another year.

"Cleaning" Flotation Products

The practice of "cleaning" both flotation concentrates and tails is another development, at least in American practice. Australian engineers make the claim that all of these ideas were worked out long ago in Australia, but nevertheless much honest new work has been done in this country, notwithstanding the claim that the ideas are old. English conservative methods of withholding

Note—Communicated by D. A. Lyon, metallurgist in charge of the Utah Experiment Station of the U. S. Bureau of Mines, in coöperation with the State of Utah; O. C. Ralston, assistant metallurgist; F. Cameron, research fellow. Published with the permission of the Director of the Bureau of Mines.

much of this kind of information have caused American experimenters to carry out to a conclusion and at their own expense some of these ideas.

Only a few years ago "rougher" and "cleaner" units were not commonly spoken of. Now almost every installation, of whatever type, is re-treating the concentrates from a "rougher" machine in a "cleaner" machine in order to drop out most of the gangue material and some of the middlings which need further treatment. Moreover, it is becoming customary to add suitable oils to the tailings for further flotation treatment in order to produce clean tailings and a low-grade middling product. These various middling products are reground in the best practice and returned to the circuit, while in other instances simple return of middlings without regrinding is common. Another point of interest has been the installation of all manner of "drag" devices for removing any froth that may form on the pulp in the subsequent handling of tailings, such as in dewatering or thickening. It is also a debated question as to whether further flotation treatment before discharge is not better practice.

Another development when using pneumatic cells of the Callow type has been to add "recleaners" for further treatment of the concentrates from the froth "cleaners." Thus we have "roughing" machines followed by "cleaners" for the tailings, and, in some installations of the Callow type, "cleaners" and "recleaners" for the concentrates. As a matter of fact, the same general sequence of treatment is followed in the many compartments or cells, in series, of the Minerals Separation type of machine.

Breaking Up the Froth

The further handling of froth concentrates has proved a serious problem for many operators when the froth has been tough and permanent. The most common method of breaking froth is by jets or sprays of water. A single strong jet of water turned on the flowing froth in a launder often results in material benefit, and a water pipe perforated with many holes to give more jets is better, while special sprays, such as rotating garden sprays (inverted), Buffalo sprays, etc., prove even more efficient. Direct feed into a filter of the pressure-filter type is most efficient, as the froth does not need to be broken up. The vacuum filters are not so well adapted to immediate treatment of the froth because it generally is too thin (25% to 35% solids) to cake well; vacuum filters of the Portland or Oliver type require approximately 50% solids in the pulp. However, by breaking the froth and dewatering, a vacuum filter is permissible. In a number of installations a bucket elevator seems to break up the froth to a satisfactory extent, actual tests made by one company indicating 80% efficiency in breaking froth, merely in the passage of the froth through the bucket elevator. Addition of chemicals, such as acid or lime, or of more oil to the froth, also tends to break it down and make the solids settle out well. If lime be used for this purpose, the mill water cannot be used again without neutralizing.

Settling of froth in bins for dewatering, while a common practice, is not satisfactory, as it practically imposes a canvas lining for the car in which the concentrates are shipped, and concentrates shipped in this manner will drain in such a "traveling filter" to about 25% or 30% moisture. In case of a long haul, this is expensive both in freight and leaks. Filters are being used in nearly all of the larger plants. Oliver and Portland filters turn out a satisfactory product with 10% to 15% moisture, and pressure filters like the Kelly, while more cumbersome and expensive to operate, are giving products ranging from 6% to 10% moisture.

Flotation Practice with Complex Sulphides

Where the flotation concentrates consist of several mixed sulphides which it is advisable to separate they are run over concentrating tables after breaking the froth. This idea is old, but its application in the United States is relatively new. Mixed concentrates made on Minerals Separation, Callow, McQuisten and De Bavay machines are now being treated in this manner in the United States.

The mention of separation of mixed sulphides in flotation concentrates suggests the work on preferential (selective) flotation. In this field there is much work being done in laboratories, and many seemingly good results are being obtained. However, most work of this kind is being guarded closely. In four separate and distinct places the idea has been adopted of separating galena selectively in the presence of sphalerite by an exact proportioning of a suitable oil, adding only enough to float the galena. This idea is old, but to see it worked out in detail and applied in the works (as it is in three instances) is gratifying.

Most of the preferential methods have consisted in the treatment of ore by some method which modifies one of the flotative minerals and prevents its floating. The Horwood process (a slight roast to deaden the surfaces of lead-sulphide particles and prevent their floating, while the zinc sulphide is unaffected) has been tried experimentally in at least five instances, and more or less encouraging results have been obtained. A patent of Greenway and Lowry reveals another proposal of adding chromates to the mill water to act on one sulphide while the other is unaffected and can still be floated. Still other methods of getting preferential flotation have been experimented with—by proper preliminary treatment of the oil, such as emulsifying, fractionally distilling, treatment with proper electrolytes, acids or other chemicals. This work is nearly all experimental-laboratory work.

Re-treatment of Tailings

The cleaning of tailings is being accomplished, as a rule, by further addition of oil and re-treatment in other flotation cells. The "step" addition of oils is claimed by the Butte metallurgists as a contribution of their own. Almost universally, oleic acid is used in the cleaning treatment of the tails of lead- or zinc-sulphide ores. It seems to be especially adapted to the purpose, though it is hard to get high-grade concentrates by its use.

Incidentally, the effect of adding an excess of any flotation oil seems to be the formation of lower-grade concentrates, which are hard to clean. Moreover, the froth is liable to be too tough and permanent to permit of its being easily broken after removal from the machine. Oil or substances immiscible with water and generally understood by that name are not necessary to flotation. Many soluble frothing agents are used that are not "oils" in any sense of the term. As the term "soluble frothing agents" has been mentioned in many of the more recent patents, the term "oil flotation" might be advantageously dropped before it gains too much headway.

Flotation Oils

The subject of oils is a most important one, and more experimental work has been done on this particular phase of the subject than on any other. Attempts to determine which oils may be best suited to the treatment of certain minerals have not resulted in deciding on any particular oil that will always concentrate a certain mineral in all cases. Pine oil is a favorite for floating both lead and zinc sulphides, though the wood creosotes are close competitors. Eucalyptus oil seems in many cases to work better than either of these, but it is too costly.

Petroleum products appear to be sufficiently selective for copper concentration; but in the concentration of lead or zinc sulphides they seem to float too much gangue. Such being the case, it may be said that petroleum oils are not well adapted to flotation work upon lead-zinc ores, as in the treatment of such ores it is necessary to produce concentrates which shall contain not less than 45% lead or zinc. On the other hand, particularly high-grade concentrates are not necessary in copper work, and a high extraction, with concentrates having a tenor of 10% to 25% Cu, is usually obtainable.

Delivered, pine oil costs from 25c. to 30c. per gal.; creosote, 18c. to 25c.; eucalyptus oil, $1.50 to $2 per gal. (Roughly, there are 8 lb. of oil in a gallon.) The petroleum products used can be bought for from 5c. to 10c. per gal.

Use of Acid in Flotation

In the use of acid in the mill water the practice differs sharply. The addition of acid seems to improve selective action, especially on galena, sphalerite and pyrite, and appears to be effective for the purpose of getting clean concentrates with a minimum of gangue. The removal of oxidized films from sulphide particles is one result. It could doubtless be used in many places where it is not now used. On the other hand, it has been found in certain instances that the presence of an acid was fatal to the process. As a rule sulphuric acid is the cheapest acid available and so is generally the one used. The amount of acid used is somewhat lower than formerly, when from 0.5% to 1% H_2SO_4 was used in the mill water. Now the average practice is from 0.2% to 0.5%.

The presence of any electrolyte seems to have a marked effect on flotation, and a set of experiments on some well-known ore, using distilled water instead of mill water, is therefore of great interest. In fact, the analysis of mill water from some of the mills where different methods are employed for treating ores that seem to be almost identical may reveal some interesting points. In our own laboratory the possibilities of new conditions arising from the use of water from the Great Salt Lake is a question under investigation.

Temperature Increases Selective Action

Whether temperature is an important item or not is also under dispute. On nearly every ore being treated it is possible to get good work done with unheated mill pulp; but a better grade of concentrates can often be obtained by heating the solution. It makes the oil and water less viscous, so that a given amount of oil will go a little farther. Moreover, less gangue rises through the more fluid water. The consideration of what would happen in the way of flotation of gangue if a mill solution composed of thick molasses were used illuminates this point. Further, the selective action due to the presence of an acid or electrolyte is promoted by a higher temperature. Hence, heating the mill pulp will be of value in those instances where concentrates of high metal tenor are wanted, as when working on lead- and zinc-sulphide ores. The temperature to which the mill water is heated is not over 65° C. (149° F.) in any case, and usually not over 50° C. (112° F.). The cost of heating to these temperatures is from 5c. to 10c. per ton of dry slimes.

Developments in Mechanical Agitation

The tendency in all mechanical-agitation methods of flotation (as distinguished from pneumatic methods) seems to be toward the more careful and rigid practice possible. A study is being made of the exact proportioning of compartments, of the beating blades or paddles on the impellers, and of the spitzkasten or settling boxes. For example, inclined blades seem to wear better than vertical ones.

The addition of froth rakes or hoes has also been made to nearly all such machines so as to remove the froth as fast as it is formed rather than to let it accumulate until it overflows by gravity. The removal of the froth in this manner avoids the breaking of bubbles and thus prevents the mineral getting back into the pulp and being lost. It also increases the capacity of the machine and permits the use of only enough oil to give a froth that breaks easily and carries little gangue.

Individual drive of each impeller from a small special motor has been adopted in one design, rather than the use of a line shaft with either belt or gear drive of each impeller. This drive doubtless costs much more for installation, but gives flexibility of control of each individual cell. Other mechanical means of mixing are being tried, such as the centrifugal pump which was used in Australia some time ago. This arrangement seems to give a low extraction and high-grade concentrates, a result capable of explanation on the assumption that the flotation conditions obtained are rather poor and that hence only the purest mineral floats, while middlings are unaffected. Such a practice makes cleaning of the tails by further treatment necessary. Having adjustable openings between beating compartments and spitzkasten seems to be nearly universal practice, though in a few of the mills visited the openings are hardly ever manipulated.

A preliminary mixing of the oil with the pulp is suggested as an interesting possibility as a result of some experiments conducted by three large companies, in which the addition of the oil was made before the material treated was passed through a tube mill. The mixing conditions were ideal and the tube-mill discharge could be run directly into a spitzkasten for separation of froth, or into pneumatic-flotation cells. This idea will doubtless be followed further.

Variation in Pneumatic-Flotation Cells

Contrary to the tendency in mechanical-agitation schemes, the pneumatic-flotation machinery is being modified, apparently, toward the greatest freedom of design possible. As an instance, the Callow cell is designed with a slanting bottom to facilitate discharge of tailings. Some mill men find flat bottoms to work just as well. In fact, every possible modification of a bottom seems to be at work. Single and quadruple thicknesses of canvas are used. The canvas may be clamped and bolted between

two strong grids of perforated sheet steel or it may be supported against some wire cloth and tacked on. It may likewise not be supported in any manner, but simply stretched tight and held by a piece of rope driven in a groove which extends around the inside of the bottom of the machine. The last-cited method seems to be about as successful as any for changing bottoms when the canvas becomes worn out.

Before treatment in the pneumatic-flotation cell the pulp is commonly mixed with the oil in a Pachuca mixing tank. In several instances a number of these Pachucas are placed in series and a good grade of froth is drawn direct from the tops of them. It is quite likely that radical changes in design will result from this experimental work. Both wooden and metal constructions are used, the metal cells costing nearly twice as much as the wooden ones.

Electrical Flotation

Among the new proposals appearing during the last year was the Fields electric-flotation process. In this process it is proposed to accomplish flotation by means of hydrogen bubbles developed by electrolysis of the solution mixed with the pulp. Fields also proposes to use air lifts to keep the pulp is suspension. It is claimed that no oil is necessary, but that it helps. The special application of this process is stated to be on partly oxidized copper ores, where the copper sulphides can be floated, and by use of a solution of a sulphate or a chloride the oxidized copper will go into solution at the anode and a rough copper cathode will finally result. Promising results have been obtained, but at an expenditure of power of about 10 times that anticipated. Whether or not this process can be made commercially feasible is a matter of considerable interest.

Flotation of Oxidized and Other Minerals

In the flotation of oxidized and other minerals much quiet work is being done. The most promising method proposed is that of "sulphidizing" oxidized minerals of copper and of lead by treatment with the proper soluble sulphide and then floating the artificial sulphides formed. This idea has been tried principally on copper ores with fair results. Treatment with hydrogen-sulphide gas, either of dry ore or suspended pulp, works well, or the sulphidizing may go on during flotation by use of ground matte and acid to react on each other and form H_2S; or solutions of hydrogen sulphide, alkaline sulphides, alkaline-earth sulphides and other compounds can be used with more or less success. The concentrates formed are never of high grade, as a great deal of gangue is carried up, especially iron. Similar work is being done in our laboratory on low-grade oxidized ores of lead, but a concentrate with only 20% of lead is a different thing from a 20% copper concentrate. The present outlook seems to be that the process will apply only to oxidized copper ores. Oxidized zinc ores seem to be unaffected by the process.

From two sources comes the welcome announcement that it seems possible to float fine metallic flake copper, and apparently native silver. Many more interesting things are being done, and it is a matter of regret that due to existing circumstances they cannot be reported in this discussion of the subject.

Coal Scarce in Germany

Berlin Correspondence

The scarcity of coal in Germany is still noticeable. The coal pool is not in a position to satisfy domestic demands, although the military authorities do everything in their power to increase the output of the collieries by releasing trained miners from the front and the home garrisons and by furnishing prisoners of war for mine work. The latter have proved efficient in underground work and appear to be glad to have found employment that will keep them in pocket money. So an increase in the output of the collieries may be expected during the coming months. It will not be sufficient, however, to cover the domestic requirements and the large foreign orders as well. For this reason the coal pool has seen fit to advise its customers that it cannot supply more than 60% of their orders.

The large demand for coal has in the meantime extended to coke, of which there is about 2,000,000 tons stacked up. As the iron industry under present circumstances will not be able to consume as much coke as it did before the war there will still be a large surplus to deal with. With such an amount of dead capital, and wages and operating materials rising in price, the collieries cannot get along with the prices of coal fixed a short time ago and are contemplating a further rise on Sept. 1.

Of the coal companies that have been able to show substantial gains during the past year the Oberschlesische Kokswerke und Chemische Fabriken is the only one that derived its profits, not from the main product for which it was built—coke—but from the byproducts—tar, benzol and ammonium sulphate. Benzol has been in increasing demand as a substitute for benzine, and ammonium sulphate as a source of nitrogen, so important for explosives and fertilizers, Germany imports in normal times $45,000,000 worth of niter. Being cut off from its sources of supply, it had to find ways and means to make good the deficiency at home. The problem has been solved by Professor Haber and other chemists of repute connected with powerful chemical works which extract nitrogen directly from the atmospheric air and make it subservient in the preparation of explosives. The manufacture has been taken in hand by the imperial government as a monopoly, and it is believed that nitrogen can be produced cheaper than by the old way.

Stanford University Yearbook and Directory

The Geological and Mining Society of Stanford University has issued its second "Yearbook," which aims to present to the alumni and former students of Stanford University, as well as to any others who may be interested, a directory of the geological and mining department and other interesting information. The directory comprises about half of the book, and gives the names of those who have ever registered in the department, with details as to the time spent therein, degrees conferred, positions held, etc. The remainder of the volume consists of articles on various geological and allied subjects, contributed by A. H. Purdue, G. H. Clevenger, H. W. Young, A. F. Rogers, C. F. Tolman, Jr., and other alumni of the university. The book is well printed and illustrated.

Meerschaum Deposits of New Mexico

By Faris V. Bush*

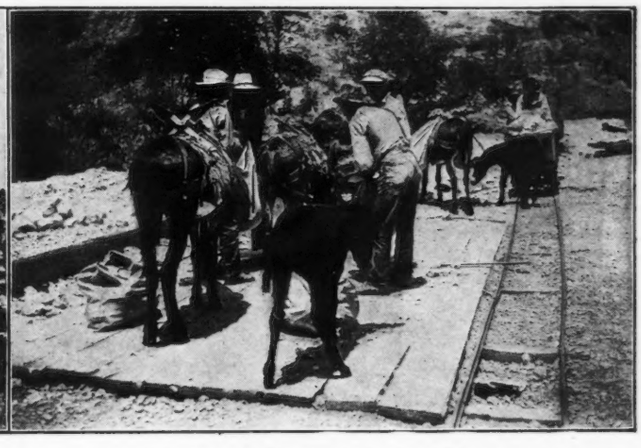
SYNOPSIS—Large deposits of meerschaum are known to exist near Silver City, N. M., and about 2,000,000 lb. of the material has been shipped. Ill-advised mining and milling processes have put the operating companies into receiverships.

Until recent years Europe and Asia Minor produced practically all the meerschaum used on the two hemispheres in the manufacture of sundry smoking articles; but America has taken its place as a meerschaum producer, and extensive orebodies have been opened up in Grant County, New Mexico, from which thousands of tons of the mineral have been mined, milled and manufactured into satisfactory meerschaum smoking articles. With the discontinuance of importation of foreign meerschaum the demand has been greatly increased for the United States product and negotiations have been attempted for shipments to Europe.

Deposits Discovered in 1875

Sepiolite or meerschaum, a hydrated magnesium silicate, was discovered, by prospectors *en route* to the Upper Gila country, in Grant County, New Mexico, early in 1875, being found as float and later in distinct veins at the surface near the Sapillo Creek. Shortly afterward Cornelius McCarty and William H. Hicks located several claims on the main vein, but were forced to abandon them owing to lack of transportation facilities. In prospectors' cabins throughout the country at the time meerschaum pipes began to take their place with briar, clay and corncob, showing the mineral's value was recognized early. Doctor Sauers and associates of Silver City, N. M., purchased the claims in 1901 and held them by doing the annual assessment. He later abandoned them and the next owner became Ed Moulton of Georgetown, N. M. About 1904 James Hill, a Colorado miner, heard of the deposits and, securing the services of James Crittenden, staked 20 claims, which were then open for location. Hill brought the property to the attention of New York parties who were tobacco dealers and who realized the commercial value of the mineral. They bought his interests, and after experimental work on milling and manufacturing meerschaum, organized the Meerschaum Co. of America in 1905 and began operations in a small way with a factory in New York. Impractical methods of mining, milling and manufacturing forced the company into the hands of a receiver. However, the product, when finished, was of a good grade and a large demand was created. The company reorganized in 1912 under the name of the American Meerschaum & Pipe Corporation, and a factory was established at Ogdensburg, N. Y., where impractical machinery and methods were installed. Contrary to the advice of engineers employed, the mines were operated without regard for the future and no effort was made to block out ore reserves. Although handicapped by limited means, the late management extracted a large tonnage of meerschaum, driving the main adit about 1500 ft. in continuous ore and stoping in many places to the surface. Early in 1914 the company was again in the hands of a receiver with a large tonnage of ore still in sight in the mines.

American Meerschaum Mill



Loading Burros at the Mine

Situation of Mines

The American meerschaum mines are located in the mountains north of Sapillo Creek and south of the Gila River in the Alunogen mining district, Grant County, New Mexico. They are 29 miles north of Silver City, over a road almost impassable, and 30 miles northwest of Hanover, the loading point on the Santa Fé Railroad, over comparatively good roads. There are 20 claims in the group, upon each of which meerschaum veinlets are traceable for hundreds of feet. The mines are 17 miles from the Dorsey meerschaum property on Bear Creek.[1] I have not had an opportunity to visit these Dorsey

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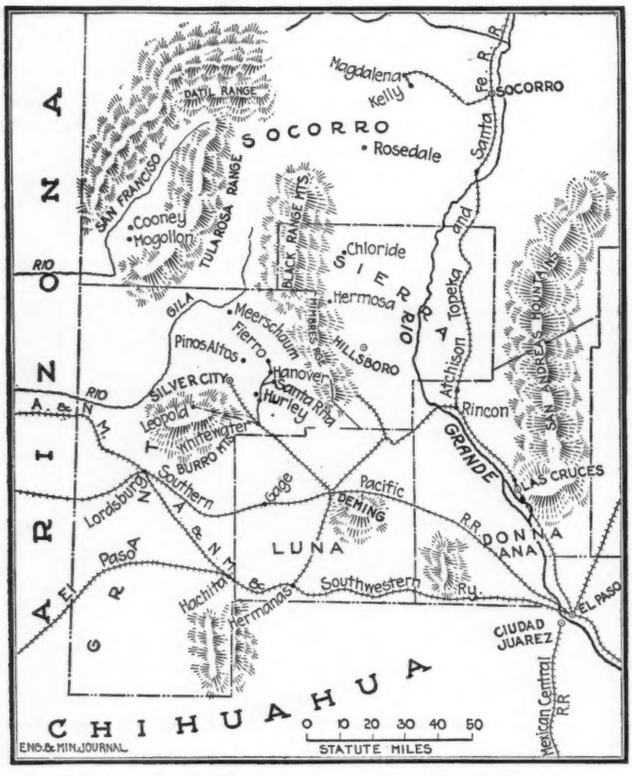
[1]Sterrett, D. B., "Bull. 340-M," U. S. Geological Survey.

mines, but am told they are not being operated on account of the large amount of water encountered at depth and cannot therefore be examined. The meerschaum of the Dorsey property differs from the American meerschaum in that the mineral occurs in nodular form in limestone and in small, irregular seams, while the mineral at the latter property occurs in distinct fissures of uniform width in a breccia. From samples I have seen the Dorsey meerschaum is of a good grade, resembling the foreign product.

The meerschaum deposits of the Alunogen district occur as a fissure filling in a breccia, greatly resembling a conglomerate. It is composed of coarse fragments, angular in appearance, irregular and unhomogeneous in character. In it are recognizable limestone, sandstone, quartz, flint, chert (which is classed as an impure flint), and calcite. The cement of the breccia is calcareous in nature, with some consolidated sand and volcanic tuff. The weathering throughout the region has been extensive and the country rock in general is exposed. It is difficult to



SILVER CITY MINING DISTRICT, NEW MEXICO

tell how it originated. The rock shows no evidence of stratification and would be classed as a volcanic breccia, being evidently an accumulation of igneous particles through volcanic action. The color of the breccia is variable, brown predominating. Renewed movement or contraction (probably both) caused the fissures in the rock. There are no faults in the vicinity of the meerschaum veins or its walls, showing it is not a friction breccia. Surrounding this area are found the Palomas gravels.

OCCURS AS FISSURE FILLING IN BRECCIA

The American meerschaum occurs as a fissure filling in the breccia, development work proving the veins to be from 1 to 2 ft. in width. The strike of the veins is almost north and south and the dip practically vertical. The analysis of the meerschaum filling is: SiO_2, 60%; MgO, 10%; H_2O, 20%; Al_2O_3, 9%; CaO, slight. The present country rock was doubtless covered by a preceding rock mass containing magnesium-bearing silicates, calcite and the characteristic alumina for which the district is named. Infiltrating waters carrying these ingredients in solution deposited them in the fissures. Later erosion has left no trace of the preceding rock masses. All indications substantiate the belief that the mineralization was formed by percolating surface waters. Meerschaum is chalk white to cream colored, fibrous, tough and breaks evenly. The texture is even throughout. The specific gravity is about 2. It is easily carved, takes a high polish and absorbs fluids rapidly.

Due to the contour of the country no shaft-sinking to any great depth has been necessary to keep the factory supplied with ore. The main workings have been in tunneling and stoping from the south side of Sapillo Mountain. The portal is located in a deep cañon cut through breccia. The adit has been driven about 1500 ft. north and stoping to the surface of the mountain has been done in many places. The greatest distance from the surface reached in the tunnel is 230 ft. All mining has been done by hand. No timbering is required other than for chutes, ladderways, etc. A raise has been made from the tunnel to the surface, and preparations were under way by the late management to sink to a depth of 100 ft. from the tunnel level and drift north and south along the strike of the vein. Thus in a short time a large tonnage could have been blocked out. Numerous small shafts, drifts and opencuts in many places on the property, consisting of 400 acres, have proved the existence of many commercially valuable meerschaum veins.

MILLING PROCESSES WERE EXPERIMENTS

While choice meerschaum, that can be carved and polished into beautiful smoking articles, is encountered in the mines, the bulk of the mineral requires a concentrating treatment to eliminate the particles of rock and foreign matter that in many places have become associated with it. The first meerschaum mill in the United States was erected about a mile from the mines of Sapillo Creek, where there is a large water supply the year round. In outward appearance it was the same as any other small treatment plant, but inwardly it was the hive of an unknown and heretofore unthought-of meerschaum-separating process. The early equipment consisted of a coal-breaker, where the ore was supposed to have been crushed to about 2-in. cubes, after which it was spread on a large drying floor in the sun and a large percentage of the water evaporated. The mineral was then pulverized in a coffee-mill to pass a 14-mesh screen. Sizing was done in a small trommel composed of a series of 50-, 30-, 20- and 14-mesh screens. After this the sized ore was treated on what is known as the Krom concentrator, a machine that could be classified as a dry jig, the principle being air pulsation under the ore passing over screens. Due to improper sizing it was impossible to obtain a perfectly clean concentrate, and only 50% of the worthless material was separated from the meerschaum. This impractical and unsuccessful method of concentration was improved upon by the later management, but only in an experimental way. An automatic drier took the place of the sun-drying platform, and wet concentration was embodied in the mill, the latter being most successful and turning out an almost pure product. The most recent flow sheet of the mill was

as follows: From mine to grizzlies to Samson crusher to Blake crusher; the material is then 2 in. or under; elevator to automatic drier to sizing trommel; oversize to coffee-mills, undersize to fine ore bins; part of fine ore to Krom concentrator, other as sized to Wilfley table; all tailings from Krom concentrator treated over Wilfley table with a 98% recovery. The meerschaum, being lighter than its gangue, reversed the process of wet concentration of copper, lead, zinc, etc. The meerschaum was washed over the table and recovered in vats at the side of the machine, while the waste material was carried to the head and discharged. The concentrate was then dried and shipped, being practically pure.

FACTORY

Krom concentrators were installed at the factory and all material shipped from the mill of low percentage was reconcentrated. All meerschaum then passed through a washing machine, where foreign matter that may have collected in transit was floated off. It was next pulverized to pass 115 mesh in an ink-pulp machine. The fine product was placed in a mixing machine and thoroughly agitated, being drawn off in liquid form into molds. The drying process took from 60 to 90 days of even temperature to solidify the blocks of pure meerschaum ready for the lathes and pipe-making machinery and waxing process.

MEERSCHAUM DIRECT FROM VEIN

As yet no commercial use other than for the purposes herewith stated has been found for this American meerschaum or sepiolite. It could possibly be substituted for asbestos, but the cost of mining, milling and transportation limits its usefulness. Doubtless future experimental work will reveal other commercial uses for the mineral.

It is estimated that since the discovery of the meerschaum deposits in New Mexico about 2,000,000 lb. of the material has been mined and turned into manufactured products. At periods, two to three cars a month were shipped east to the factory. Recent investigations have been made by French capitalists and others relative to shipping the meerschaum abroad for manufacturing into pipes and for other purposes to which it appears adaptable.

Changes in Rand Practice

In the course of his annual review as consulting engineer to the Central Mining & Investment Corporation, whose report has just been published, Hugh F. Marriott, says the *Financial Times,* London, May 5, 1915, makes the following statements concerning metallurgical and mechanical practice on the Witwatersrand:

"The latest mill design includes tube mills in the proportion of one to sixteen 1250-lb. stamps, with screening of 10 mesh (I. M. M. standard). With the heavier stamps more recently erected on the Rand this ratio is proportionately varied. . . . The machine-drill problem continues to receive close attention, with continued satisfactory results. Heavy piston drills still remain the chief factor in general stoping work, but the smaller types of both reciprocating and hammer drills are taking an increasing share in mining operations and have been proved of greater efficiency in certain branches of development work and in subsidiary operations. It is generally found that the smaller types now in use cost more in maintenance than the heavy machines, but are capable of considerably greater drilling speed. The consumption of drill steel, and the expenditure of compressed air per unit of work have been materially reduced in the course of the year."

National Mine-Rescue Meet at Panama-Pacific Exposition

The third annual Joint Field Meet of the United States Bureau of Mines, the American Mine Safety Association and the California Metal Producers' Association will be held at the Panama-Pacific Exposition, Sept. 23 and 24. It is expected that there will be a large attendance of mining men, as the joint meet will either precede or follow the annual meetings of a number of institutions allied with the mining interests, such as the American Institute of Mining Engineers, Sept. 17 and 18; the International Engineering Congress, Sept. 20 to 25; the American Mining Congress, Sept. 20 to 22; the California State Mine-Rescue and First-Aid Contest, Sept 22; and the National Safety Conference, under the joint auspices of the National Safety Council and the California Industrial Accidents Commission, Sept. 27 to 30.

On Sept. 23, on the athletic field of the Panama-Pacific International Exposition, there will be a mine-rescue demonstration at 10 o'clock; at 2 o'clock in the afternoon there will be a first-aid demonstration; and at 4 o'clock a demonstration of the explosibility of coal dust.

On Sept. 24, at 10 o'clock, will be held a first-aid contest for interstate supremacy; at 2 o'clock in the afternoon, a rescue contest for interstate supremacy; at 4 o'clock, a rock-drilling contest; and at 8 o'clock in the evening there will be an award of prizes and souvenirs at the Convention Hall.

United Globe

The United Globe Mines, Globe, Ariz., reports a production during 1914 of 11,086,674 lb. of refined copper, 91,582 oz. of silver and 1579 oz. of gold from 155,205 tons of ore. The average grade of all ore was 3.57% copper. The receipts from the sale of this ore amounted to $1,095,560. Expenses were $663,022, leaving a net profit of $432,538 for the year. This profit is before deducting depreciation. Dividends totaling $425,500 were paid, making dividends to date $1,955,000. The principal product of the United Globe Mines is concentrating ore.

A New Wall Map of Alaska, 82x55 in., can be purchased from the Geological Survey, Washington, D. C., at 80c. a copy. It includes the survey of the new Government railway from Seward to Fairbanks.

Details of Practical Mining

Bucket-Dumping Device

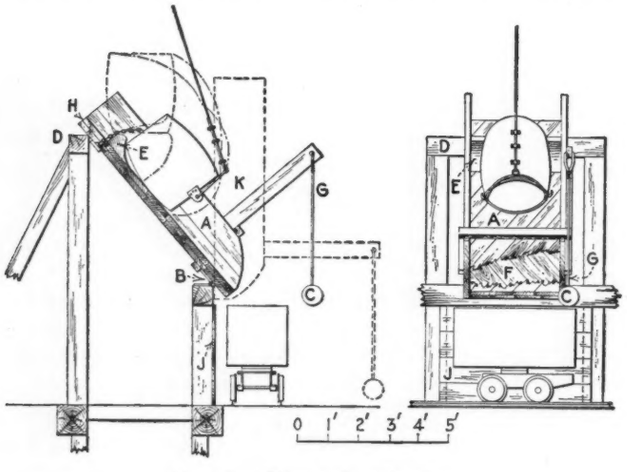
By Harold A. Linke*

A safe and serviceable device for dumping buckets at the collar of a shaft during sinking operations is constructed as follows:

A chute *A* is built of 2x10 plank, the width depending on the size of the bucket used. The sketch shows a convenient size for use with a bucket of 9-cu.ft. capacity. The floor is laid diagonally and doubled, one set of plank crossing the other at acute angles, as shown at *F*. The sides, two plank high and of single thickness, are reinforced with cleats and strap iron.

The chute is hinged at *B*. At the center of the chute at the upper end a slot *H* is cut about 12 in. long and 2¼ in. wide, reinforced around the top and bottom edges with bands of strap iron bolted together through the flooring. *C* represents a counterbalance to assist in raising and lowering the chute.

When the filled bucket reaches the collar of the shaft



Bucket-Dumping Device

it is hoisted high enough to clear the chute, which, being raised, is in position *K*. As the bucket is then slowly lowered the topman simultaneously lowers the chute. A 6-in. plate of ¾-in. iron fastened to the end of a chain (about 21 in. long) suspended from the bottom of the bucket is caught in slot *H*. The bucket and chute are then slowly lowered until the top of the chute strikes the bumper *D*. As the bucket is lowered for dumping, the curved block *E*, gouged somewhat in the center to fit the bucket, thus preventing lateral motion, raises the bottom end of the bucket high enough to allow the contents to be completely removed. After dumping, the topman raises the chute while the bucket is being swung clear by pulling downward on the rope *G*.

An important detail to be observed in building a dumping chute of this sort is to make the block *E* about 15 in. long, curved as sketched and gouged to prevent the rolling motion of the bucket. Fasten securely five strips of strap iron on the block for the bucket bottom to slide on, facilitating dumping and affording protection against wear. Occasionally grease the iron strips.

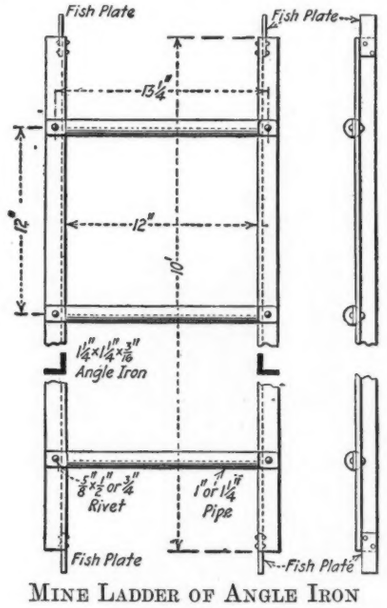
It is advisable to board up the bent on the car side of the shaft, as shown at *J*, to prevent dirt from dropping down the shaft.

*401 Sixth St., Calumet, Mich.

Capital Mine Steel Ladders

By Edward S. Wiard*

The details of the steel ladders used at the Capital mine, Georgetown, Colo., were worked out by the superintendent, E. C. Bauman. The principal advantages of these ladders as against wooden ones are lightness, portability, greater cheapness in the long run and great safety. The steel ladders are practically indestructible. The drawing shows the construction and dimensions. The rounds are made of old air pipe. This is cut up into suitable lengths, after which both ends are heated in the forge and mashed flat. The flattened ends are then ready to be drilled and cold-riveted to the angle iron forming the sides of the ladders. The ladders at the Capital mine are made in the easily handled length of 10 ft. and are held in place in the manways by ladder hooks placed in the usual way. To hold the ladder away from the wall plates—if this procedure is necessary to give a good foothold—blocks may be inserted between the ladder and the wall, the hook embracing both block and ladder. If desired, four pieces of steel of the same size and shape may be riveted in pairs to the two ends of the ladder to attain the same purpose—that of holding it away from the sides of the manways.



Mine Ladder of Angle Iron and Pipe

As fast as the ladders are put in place they are connected to the lengths above or below by fish-plates and bolts, so that each section receives the support not only of its own ladder hooks but of all the others—an advantage in security missing with wooden ladders put up in the ordinary way. The sections of the ladder are easily taken apart and moved from place to place.

*Mining engineer, 422 Boston Building, Denver, Colo.

Wooden ladders, as is well known, are often injured beyond repair in being taken down. The steel ladders are free from rot, wear but slightly, and are little affected by falling objects. The strength of the steel ladders is great and the sense of security while using them is also great. They could not, of course, be recommended for use in manways where there is dripping coppery water.

The weight and cost of constructing these ladders at the mines are as follows:

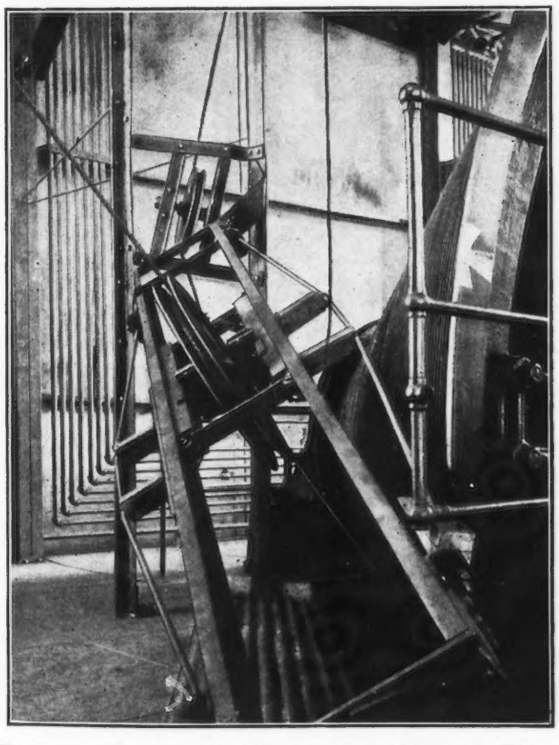
	Weight, in Pounds		Cost
Rivets and bolts	3		$0.30
Angles	30		.83
Pipe	27	(half price)	.50
Fish-plates	1½		.04
Total	61½		
Labor			.86
Total cost			$2.53

If the pipe is considered worthless the cost will be reduced to $1.67. The material for wooden ladders will cost from one-fourth to one-half the steel; the labor cost will be as much or greater. The greater cost of the steel ladders is soon made up by the longer life.

Fleeting Device for Hoist with Conical Drums

By F. H. Armstrong*

On the Brier Hill hoist of the Penn Iron Mining Co. are two 12-ft. cylindrical drums, one for the skip and the other for the cage. There are also two conical drums, from 4½ to 17 ft. in diameter, which are used for counterbalancing the dead loads. The hoist is located so near to the headframe that the sheave to which the counterbalance rope leads is in line with one end of the conical drum, thus pulling very heavily sidewise on the deep grooves.



Fleeting Device for Hoist with Conical Drum

To correct this a channel iron track was set up in the hoist house, in which runs a carriage carrying a sheave. The carriage and sheave are pulled up the track by a rope leading from the carriage to a drum that is driven by a worm and wormwheel from the main shaft of the conical drum. The speed of this small drum is such that it pulls the carriage across the face of the conical drum the distance between two adjacent grooves for every complete revolution of the conical drum. The illustrations show the carriage, sheave, track and rope leading to the small drum.

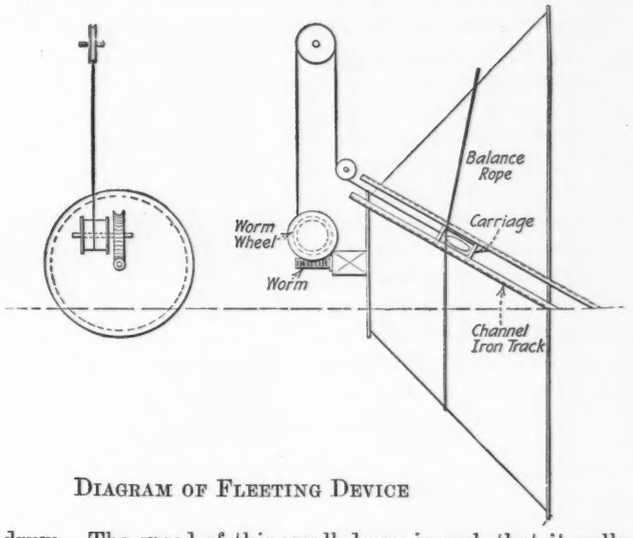


Diagram of Fleeting Device

Mining Methods in Southern Kaolin Deposits

In the southern states where kaolin occurs in decomposed dikes from 15 to 25 ft. wide it is mined by sinking shafts or pits timbered in an interesting and ingenious way, described by Lloyd T. Emory* in *Engineering News,* Feb. 25, 1915. It was necessary to devise a plan by which the timber could be used repeatedly, and one which would also leave the pit free from braces, so that the hoisting of skips with a derrick would not be interfered with.

The shafts are from 20 to 25 ft. in diameter, depending on the width of the dike, and their average depth is about 60 ft., although they are frequently sunk to a depth of over 100 ft., even through soft and sometimes treacherous material.

The pit is first dug about 4 ft. deep, keeping the hole round by means of a piece of plank swung around a peg in the center, as a gage. The pit is then lined with 3x8-in. planks cut in 3-ft. lengths with mitered ends, laid *flat;* fitted together, a layer of these planks forms a complete ring around the pit. The first ring of timber is laid around the bottom of the pit, a second placed on top of it, breaking joint; these two are spiked together. Then the rest of the curbing to the top of the excavation is laid up, always breaking joint. Sections of 6 or 8 rings are placed at a time. Every fourth or sixth set of timbers is spiked to the ring below with 40d. nails, to prevent slipping.

*Mechanical engineer, Vulcan, Mich.

*Civil engineer, 2 South 15th St., Philadelphia, Penn.

It can readily be seen that this curbing will act as an arch, like the wall of a pipe under external pressure. Therefore considerable care is necessary to see that any vacant space behind the timbering is thoroughly tamped with dirt, as soft spots behind the wall will allow the timbering to be deflected from a circle, which will throw unequal stresses on different portions and may result in failure.

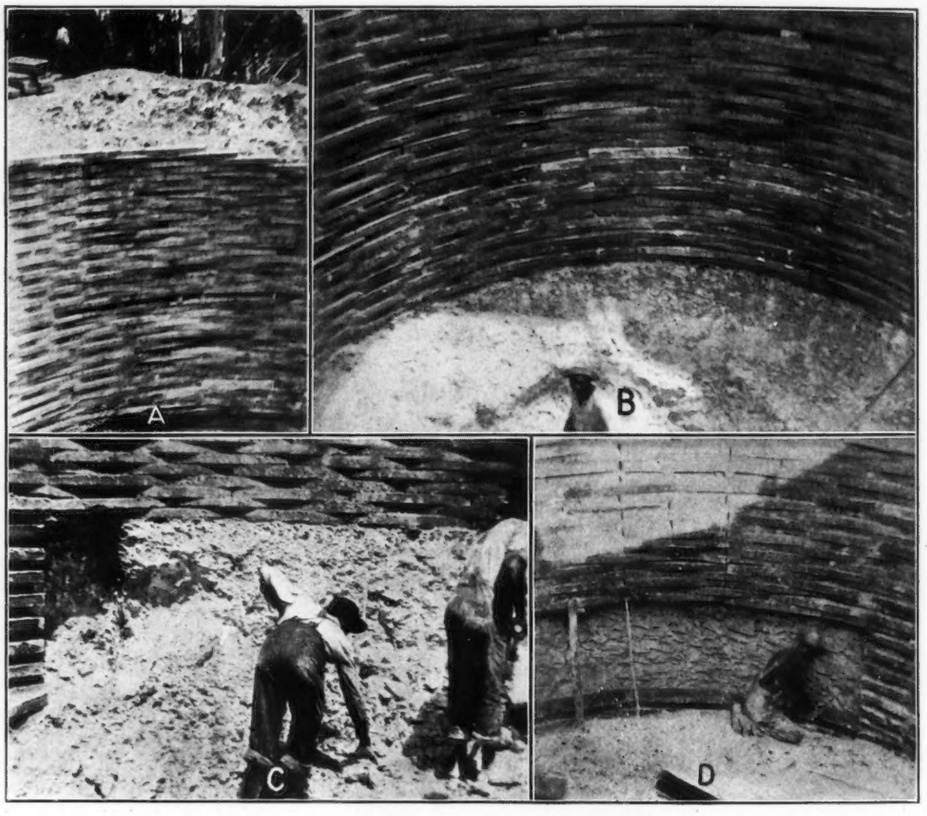
After thus curbing the shallow pit first dug, the work is continued by excavating another 4-ft.-depth, but using a smaller radius, leaving the timbering already in place resting on a ledge. If the material is firm, this ledge may be cut down almost straight with the inside edge of the timber. In case of very soft saturated material it may be necessary to leave a toe 6 to 10 in. wide and thence slope the material toward the center of the pit. In working in wet ground a small sump may be dug on one side of the pit and the floor kept so sloped that all the water can be either bailed or pumped from this depression.

When the pit has been excavated at the smaller radius to about 4 ft. below the bottom of the timbering, narrow vertical trenches are cut into the sides under the timber at frequent intervals around about a third of the circumference of the shaft and temporary wooden struts placed to support the bottom ring of timbering. The earth between the struts can then be excavated to the full radius and another section of timbering started. The second ring is always spiked to the bottom one, and every fourth or sixth spiked as previously described. The ends of this timbering where it will join the adjacent segments can be either "stepped down" or "sawtoothed." It is well to use the first method on one end and the latter on the other. As soon as this timbering is in place the performance is repeated with another segment, and so on until a complete section is in place.

Sometimes difficulty is experienced in putting in the last piece of timber of a section. If the ring cannot be sprung enough to get it in, a short piece of timber is used so as to allow a 3x3x8-in. key to be inserted which is toe-nailed to the adjoining timbers.

The number of rings which can be put in at a time depends upon the character of the soil and is best determined by experience. Where a trustworthy man is employed as foreman it is best to leave the number to his discretion. It is not advisable to place less than four rings, and eight rings are about the maximum that can be placed at one time.

To remove the timbering the shaft is backfilled with waste from other workings. The work is done in a similar way to the excavating, but in the reverse order. In most cases the pressure of the earth against the sides will make each section practically self-supporting, but as a precaution props extending toward the center of the shaft are placed so as to support the lining 4 or 5 ft. above the bottom. The lower section of timber is then removed from below the props and the shaft backfilled up to the bottom of the timbering. It is customary to excavate a new shaft as the old one is being filled. In this way the timbering can be handled by one derrick for both holes and the overburden and trimmings from the new excavation dumped into the old one as fast as taken out.



A—Upper Part of a Deep Shaft. B—Excavating in the Center before Starting a New Section. C—New Section of Lining Started. D—Preparing to Close a Set of Rings

The average cost of excavating by this method, for five shafts, was 54c. per cu.yd., exclusive of the cost of the timber, which was used repeatedly.

Failure and Heat Treatment of Drill Steel

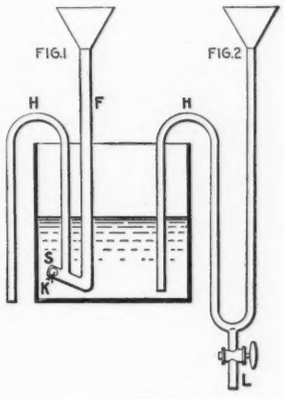
In the Journal of Apr. 3, 1915, p. 613, the author intended the caption "Ruptures as Developed from a Partial Break in Steel," instead of "Sulphide Accretions in Steel."

A Bulletin on Explosions in Metal Mines and quarries has been issued by the Bureau of Mines. The bulletin contains chapters on combustion and explosion; blasting and mine explosives; fuse, detonators, and electric detonators; firing blasts by electricity; the use of explosives in excavation work; the use of explosives in quarrying; the use of explosives in metal mining and tunneling; drilling and blasting methods on New York rapid-transit tunnel; magazines and thaw houses; permissible explosives, etc. This publication is Bulletin 80.

Details of Milling and Smelting

Acid-Siphons

Some new designs of acid-siphons are described by W. Szigeti (*Chem.-Zeit.*, p. 122, 1915; abstr. *Journ. Soc. Chem. Ind.*, Mar. 31, 1915). Two patterns of acid-siphons constructed entirely of metal (lead or aluminum) are illustrated. Both are started by pouring some of the acid into the funnel at the top. In Fig. 1 the vertical charging tube *F* is of larger bore than the siphon proper and is bent at an angle at the bottom terminating in a hole *S*, constricted to the size of the siphon tube *H*. When liquid is poured quickly into the funnel, a larger quantity passes down the tube *F*, than can flow through the hole *S*, and the excess rises in the tube *H*, starting the siphon. A glass ball, *K*, may be placed in the short branch to act as a check-valve in the hole *S* during starting, falling back again when the siphon starts. Fig. 2 shows a pattern constructed of aluminum for nitric acid, with a tap *L* for intermittent use without recharging.



ACID-SIPHONS

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Carbon as a Precipitant of Metal from Cyanide Solutions

The precipitating action of carbon and graphite upon gold in cyanide solutions has been commented upon and discussed at length in numerous papers. A new one has just appeared giving a description of the experiments of W. R. Feldtmann[1] upon some graphitic or carbonaceous schists occurring in the properties of several of the West African gold-mining companies. After a thorough description of the experiments undertaken and the explanation and tabulation of a large number of tests, Mr. Feldtmann expresses his conclusions as follows:

"It has been demonstrated that the graphitic schists of West Africa precipitate gold from auriferous cyanide solutions in a manner which is, in all important respects, analogous to the action of charcoal under like conditions. The gold is precipitated on the charcoal (and on the schist) not as a metal but as a compound—possibly a carbonyl aurocyanide. This gold compound is decomposed and the gold dissolved to a considerable extent by alkaline sulphide solution. Judging by the results of a large number of tests, the re-solution is effected rather more easily from the schist than from the charcoal.

Whether the discovery that alkaline-sulphide solutions will dissolve gold which has been precipitated on the carbonaceous schist can be turned to practical utility in the cyanide treatment of ores containing such schists is the subject of experiments being carried on at present. By post-treating with sulphide solution the sand residue from which a maximum extraction had previously been recovered by cyanide treatment, a further extraction has been obtained from a large number of samples, and there is some promise that an economical post-treatment may be evolved on these lines. The precipitation of the gold from the sulphide solution in which the gold is held as alkaline aurocyanide, with hardly any free alkaline cyanide but with a large excess of alkaline sulphide, appears to be best effected by contact with metallic copper.

[1] "Bull. 127," I. M. M., Apr. 8, 1915.

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Electric-Arc Welding*

Electric welding comprises two general processes—electric-arc welding, which is best suited to general repair work, and resistance welding, which is most applicable to manufacturing processes where many duplicate pieces of light sheet work are to be welded. For general repair work, however, where cutting, joining and building up of metals are to be done, arc welding is employed.

Direct current is used in electric-arc welding because the alternating-current arc varies from a maximum to a minimum at each reversal of the current, and hence is not suitable for welding service. The direct-current arc is practically steady, the temperature obtained is high (approximately 3500° C. at the positive electrode), and the heat generated at the positive terminal is approximately 75% of the total heat generated in the arc.

The carbon arc is longer than the metallic arc and is, therefore, more stable and less liable to break. The metallic arc is extremely short, being only from ⅛ to ¼ in. long. After the arc is established, it can be moved about over the work by merely moving the electrode. The carbon electrode can be used to preheat the work by keeping the electrode moving rapidly enough not to melt the work.

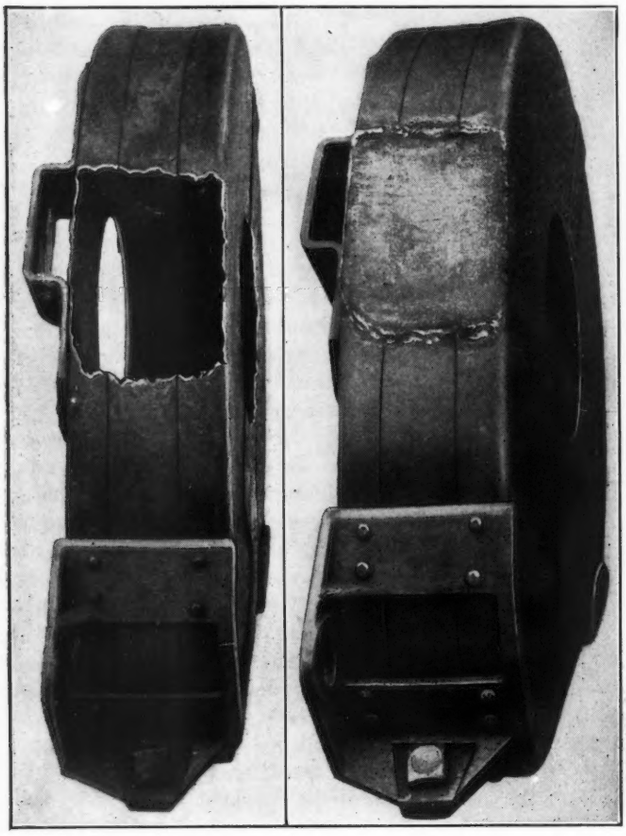
In working with the graphite electrode there must be a potential across the arc of from 35 to 50 volts, depending on the current being used. The current varies from 200 amp. up, depending on the type of work being done. In light work, small electrodes and less than 200 amp. can be used. The average type of welding done by this method will require from 300 to 400 amp. For cutting, the graphite or carbon electrode is unequaled for speed and low cost. The arc cuts rapidly, because the heat is concentrated on a small area. To augment the cutting speed, all that is necessary is an increase in current.

The metallic electrode permits much lower amperage than the carbon electrode. Currents as low as 15 amp. are used, and the upper limit is about 200 amp. The voltage at the arc is only from 20 to 25 volts. The metallic electrode can be used on much lighter stock than can the

*Abstract from General Electric Bull. No. 48,904.

carbon electrode. It requires greater ability on the part of the operator, however, on account of the shortness of the arc and the consequent difficulty of maintaining it; but this is compensated for by the fact that certain classes of welding that are possible by this method cannot be done by the others. Among these is welding overhead or on vertical surfaces. Further, there is no possibility of carbon being carried into the weld.

Cast and malleable iron can be successfully welded by the electric arc provided certain precautions are taken. For this type of welding, the work should be preheated either by the use of the carbon electrode or by means of gas, coal or oil fires. The work should be brought up to a red heat and the heat carried back from the weld, or cooling strains, and probably cracks, will follow. The



A Gear Case Welded with the Electric Arc

work should be kept hot during the time the weld is being made.

Flux is of great assistance in welding cast iron. One commonly used consists of a mixture of borax and red oxide of iron. The borax should be heated to drive out the water of crystallization before using the flux. This mixture is supposed to prevent carbon entering the weld, and also to keep the surface of the metal in the weld clean and so permit a better union of the metal.

Metallic electrodes for welding steel or iron consist of rods from $\frac{1}{16}$ in. to $\frac{1}{4}$ in. in diameter and about 12 in. long. The better the material used, the better will be the weld. The carbon or graphite electrodes vary in size from $\frac{1}{4}$ in. to $1\frac{1}{2}$ in. and more in diameter and should consist of hard, solid and uncored carbon, similar to that used in arc lamps. The end of the electrode should be rounded off, but not brought to a sharp point. The filling material used with the carbon electrode should be of the same kind and quality as that which is being welded.

Any direct-current source can be used for arc welding, but the voltage must be reduced from 10 to 50 volts. This may be done by inserting resistance in series with the arc to absorb the excess voltage. This is plainly an inefficient method of operation, as the voltage absorbed by the rheostats is energy wasted. In order to avoid such losses, the General Electric Co. has developed a line of special, low-voltage generators and a method of control, which give the maximum of efficiency, combined with flexibility and protection. The generator should be wound for a voltage of from 60 to 75 volts. In no case is it necessary to have a generator of higher voltage than this for welding. Lower voltages may occasionally be used with extremely light currents.

The generators are usually furnished as part of a motor-generator set, although they can be supplied for belt drive if desired. The motor-generator set is the most desirable equipment for several reasons. It is a self-contained unit, does not demand constant attention when running, and the maintenance cost is low. The welding circuits and the shop circuits are electrically independent, so that short circuits in a welding circuit will not seriously interfere with the shop circuits. The voltage on the welding circuit can be regulated to suit the work in hand by adjustment of the generator field rheostat.

Zinc-Sodium Alloy as a Precipitant in Cyaniding

Having in mind the difficulty of producing mechanically a finely divided zinc product for use as a precipitant in cyanide operations, Prof. G. H. Clevenger (U. S. pat. 1,123,685) has conceived the idea of making an alloy of zinc with some other metal with the object of producing a compound which will be brittle and easily comminuted. Heretofore the forms of zinc used have been the filament, cut from sheet zinc on a lathe, and the zinc fume or zinc powder, which is a byproduct of zinc smelteries. By producing a brittle alloy it will be possible to use scrap zinc and to manufacture zinc dust at the plant where it is to be used.

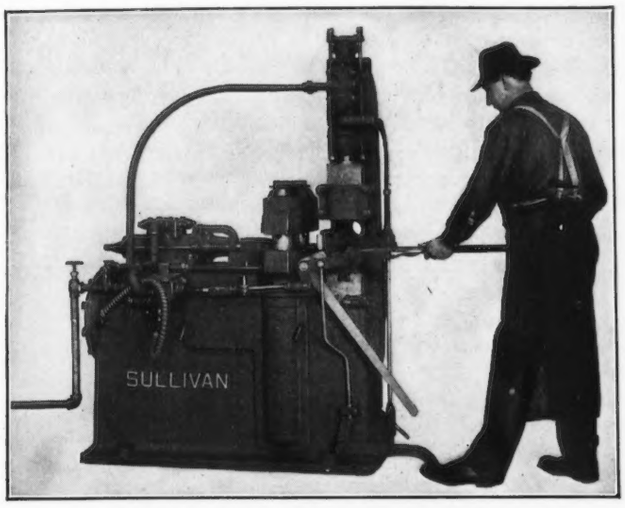
Clevenger alloys the zinc with sodium, in quantity not over 3% of the latter, or with any other alkali or alkaline-earth metal which will impart brittleness to the resultant alloy. The alloy produced will have a much greater efficiency from a chemical point of view, as the presence of sodium and possibly lead in the alloy brings about a quicker action and necessitates the use of a smaller amount of precipitant, even though the mechanical subdivisions remain approximately the same as with the ordinary zinc dust of commerce.

"Part of the Coke Used in the Mt. Lyell Blast Furnaces is put in merely to allow the metallurgist and his assistant to go home and sleep," said Robert Sticht at a dinner of the New York Section of the American Institute of Mining Engineers. "The metallurgist and his crew are only human beings, and we spend a lot of money annually keeping them sweet and fresh and in good, vigorous and healthy running order. If everyone around the furnace were a highly qualified academic chemist, who could give his unremitting personal attention to the descent within the furnace of every piece of ore and flux, then we might perhaps omit the coke altogether, but ordinary flesh and bone cannot do it. We have, of course, occasionally smelted without coke for a day or two, but cannot keep it up." The low coke percentages—0.1 to 1.5%—achieved at Mt. Lyell are no longer possible owing to the change in the constituents of the ore. Instead of having from 42 to 44% of iron, the Mt. Lyell ore now carries only 35%, and a corresponding amount of sulphur. The result of having a poorer ore is that from 3.5 to 5% of coke is now used.

Mining & Metallurgical Machinery

New Sullivan Drill Sharpener

A new drill-making and drill-sharpening machine is to be introduced by the Sullivan Machinery Co. This new Sullivan machine has been designed on the lines of the Imperial sharpener, for a number of years built by T. H. Proske, of Denver, who has granted the Sullivan company exclusive manufacturing and sales privileges. The Sullivan machine, however, bears only a family resemblance to its Denver prototype. The new machine is larger, more heavily built, more powerful, and is about double the weight of the old one.



NEW SULLIVAN SHARPENER IN USE

The Sullivan sharpener consists of two members, one horizontal, the other vertical, consisting of Sullivan 2⅝-in. rock-drill cylinders, with differential air-thrown valve motion. The horizontal drill or hammer is used for upsetting the steel into the shape of the bit or shank by means of suitable steel dollies loosely set on the end of the shank or distance piece. The vertical member is used for shaping the wings of the bit, etc., and for drawing out and finishing the corners. This work is done by steel dies, one acting as an anvil and the other, attached to the piston rod above, as a swage or hammer. The steel is held in position while being upset by steel gripping dies set in a heavy vise, which is operated by air power.

This sharpener occupies a floor space of 5x2½ ft., is 6 ft. high and weighs 4000 lb. Safety is assured thus:

1. The operator cannot start the upsetting hammer until the clamp or vise is in operation.

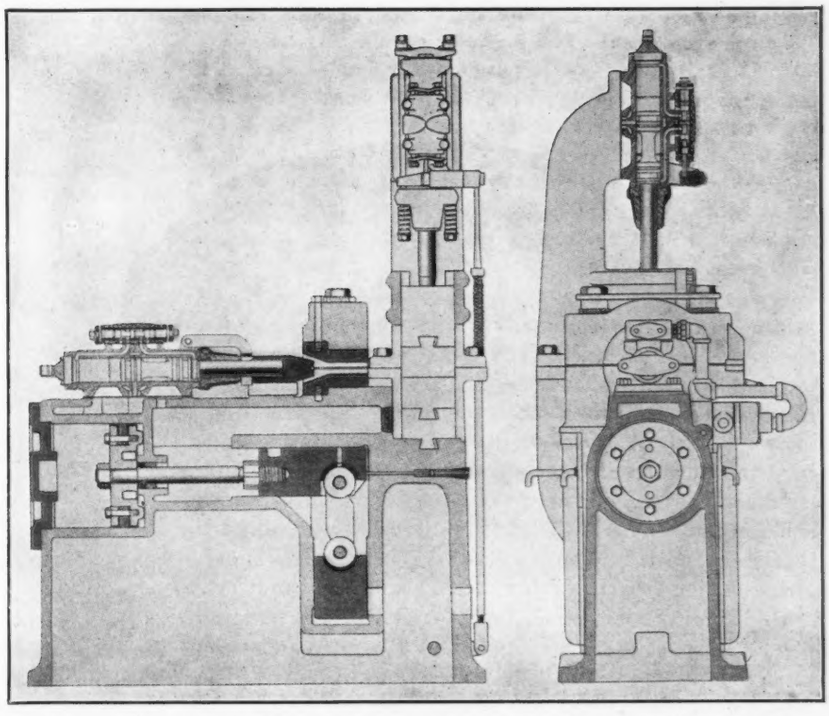
2. There is a positive guard against operating the vertical hammer while the horizontal one is at work.

The operating levers are so placed that the smith uses them conveniently with his left hand and left foot, bringing his right hand at a proper point to handle the steel readily.

The absence of a long carriage and tail block to hold the steel in position is a saving in floor space and in labor. A blacksmith can with a little practice finish new bits in from 50 sec. to one minute each.

Bits of any form and gage may be made on this machine, on steel of any shape, solid or hollow; and shanks also may be formed to order, provided proper dollies and dies are furnished. The collared shanks on hollow steel for rotators or hand-feed hammer drills and the lugged shanks for mounted water-jet hammer drills are two forms that are made economically and rapidly on this machine.

The clamp or vise is equipped at the front end of the jaws with steel plates, to permit its use as an ordinary vise. One use of this vise consists in removing the steel pins that are driven into the shank end of hollow steel to keep the hole open when the lugs or collar is formed. To pull these pins, they are gripped in the vise, and a purchase taken on the lugs or collar with the forked end of the loose lever hanging down below the operating handle. This device is speedy and convenient.



SECTIONS THROUGH CLAMPING, UPSETTING, AND SHAPING CYLINDERS

It is an accepted fact that, so far as the character of the steel is concerned, no improvement on or even satisfactory substitute for, the making and sharpening of drill bits by the handwork of a skillful blacksmith has been found. The drill-sharpening machine makes bits faster and more uniformly, as to shape and gage, than the most expert hand smith. But the qualities given the steel by the constant hammering of the bit on the anvil are not secured by mechanical means, such as squeezing or molding, sometimes used as a substitute. In other words, the hammering refines, toughens and aligns the structure of the steel in the direction that gives greatest resistance to wear and shock. This is the effect secured by the Sullivan sharpener, in which all work, from first to last, is done by hammering, so that to the uniformity of gage, etc., are added the qualities of increased durability, toughness and strength.

Another element in the efficiency of the "all-hammer" sharpener is that hammer-sharpened bits lose heat less rapidly than steel that is squeezed or molded into shape. This is an important time factor when many bits are to be made in a day.

Halby Shoveling Machine for Underground Mining

The efficiency of drilling machines has been increased manyfold in the last few years, but a great loss of time and money in driving drifts and tunnels at present is still incurred in mucking. After the rock and ore are broken, with but few exceptions mine operators are still using the methods of loading and mucking by hand which were in vogue over two thousand years ago. Recently the Halby shoveling machine, manufactured by the Lake Shore Engine Works, of Marquette, Mich., has been operated successfully for six months in one of the iron mines of northern Michigan, under the most varied conditions.

The most important factors which a shoveling machine should possess were carefully considered in this design. They are as follows: The first cost should be moderately low. The machine must be handled by miners and should be free from all complications. It must handle material consisting of the finest grains up to large boulders, material both wet and dry, and stand severe treatment as well as great wear and tear. The cost of upkeep must be low. The motion must be such that if any firm object is struck the mechanism will not be damaged. The machine must be small and compact.

This shoveling machine was first demonstrated at the plant of the Lake Shore Engine Works last fall, at the meeting of the Lake Superior Mining Institute held on the Marquette Range. After the meeting it was shipped to the Judson mine at Alpha, where it is at present loading a 2-ton car in an 8x8 drift in 1½-min. when the loading conditions are average—that is, when there is a fair-sized bank of ore in front of the machine. At times the ore bank is small and scattered so that under these conditions it takes as much as 4 min. to load a 2-ton car; but an average loading time is a 2-ton car in about 3 minutes.

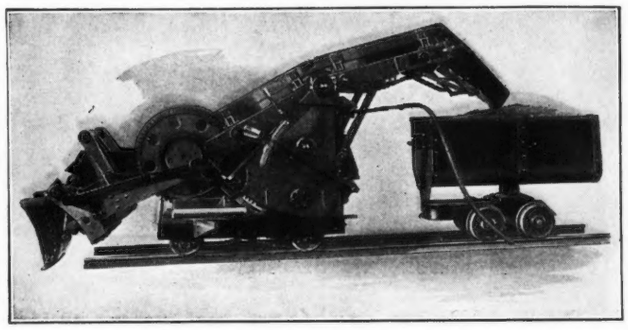
Under former conditions, with hand labor, it required two men shoveling 20 min. to load a 2-ton car under the same conditions as the machine is now working. The machine requires about 200 cu.ft. of air per min. The cost of operating for an 8-hr. shift is approximately as follows:

Power	$3.00
Runner	2.50
Interest on investment	.20
Repairs	.50
Oil, etc.	.17
Total cost per 8-hr. shift	$6.37

Figuring 200 tons loaded per 8-hr. shift shows a net cost per ton of $0.031. The labor expense of two men loading for an 8-hr. shift would be $5 per day. Under similar conditions they would load approximately 40 tons in 8 hr., or a cost of $0.102 per ton. The Halby shoveling machine, therefore, loading for less than one-third the cost, at the same time loads five times the tonnage.

The overall length of the machine when ready for operation is approximately 15 ft., but the machine can in a few minutes be shortened to an overall length of 10 ft., if especially short curves or limited space should make this necessary. The overall height of the machine is 5 ft. 4 in., and the total width approximately 4 ft. The total weight is 7500 lb.

The machine is made up in three distinct sections, each forming a unit by itself. The top section contains all the working parts for the conveyor and shovel mechanism.

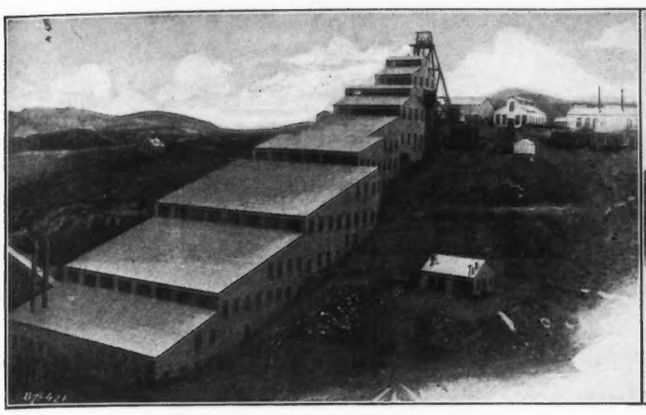


HALBY SHOVELING MACHINE

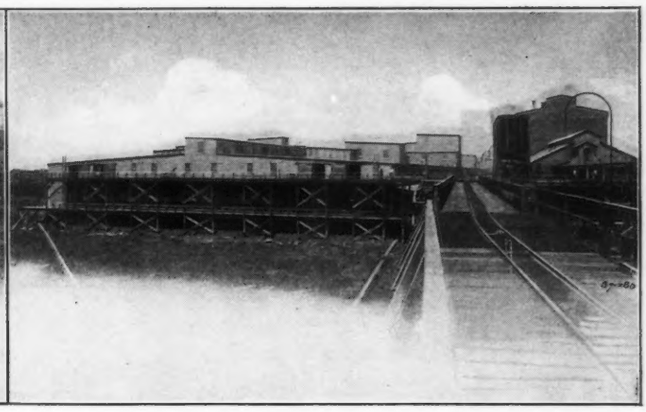
The center or power section contains the motive power, all the clutches and the driving gears. The lower or truck section serves as a support for the entire machine. The top section can be lifted off the center section by removing two caps at the top of the side frames. The center section can simply be lifted from the truck, there being no bolted connections between them. This construction feature makes this loader especially adapted for mine and tunnel work where it often becomes necessary to move through openings too small to allow the entire machine to pass.

Asbestos-Protected Metal

Asbestos-protected metal, brief mention of which was made in the JOURNAL of Nov. 8, 1913, consists of steel sheets, of from 18 to 26 gage, immersed hot in melted asphalt, into which long-fiber asbestos is pressed. The asbestos surface is then finished with a waterproofing compound. By this process is developed a material with the strength of steel, but proof against weather, acid fumes and fire. In addition it is a protection against sudden changes of temperature, and in general it is claimed that a building covered with this material will be cheaper to heat in winter and will be cooler in summer than that of ordinary construction. The material is finished in one of three different colors, so that painting is unnecessary, and this expense is avoided.



NEVADA HILLS MINING CO., FAIRVIEW, NEV.

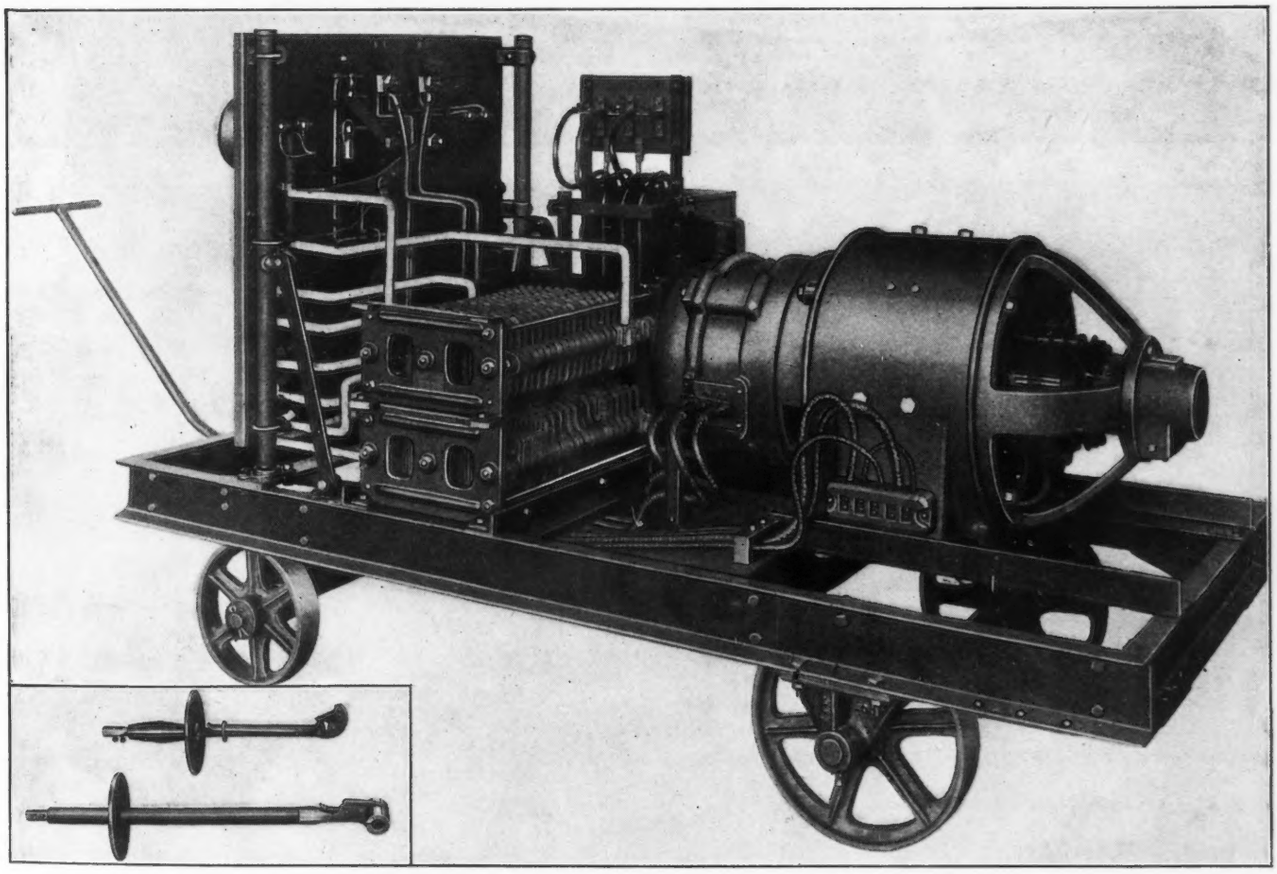


ARMOUR & CO.'S ACID PLANT, CHROME, N. J.,

Its use under two very dissimilar conditions is shown in the accompanying illustration. In the Nevada Hills plant it is used to eliminate interior condensation under trying daily extremes of temperature, while in Armour & Co.'s acid and fertilizer plant at Chrome, N. J., it is used as a protection against acid fumes, both from the plant itself and the nearby metallurgical works; while it also is exposed to the corrosion of moist sea air.

In addition to plain, beaded and corrugated sheets, asbestos-protected metal is furnished in ridge caps, flat flashing, etc. It is made by the Asbestos Protected Metal Co., First National Bank Building, Pittsburgh, Penn.

Some Useful Adjuncts to Mining



ARRANGEMENT OF 300-AMP. PORTABLE ARC-WELDING EQUIPMENT

Electric-arc welding is being applied to repair work in cutting, joining and building up metals, special apparatus having been developed for this purpose. A portable equipment made by the General Electric Co., of Schenectady, N. Y., is shown in the accompanying illustration. This consists essentially of a driving motor, a welding generator and a main switchboard panel on which is mounted the necessary controlling and indicating apparatus; a face shield for the operator is supplied, and electrode holders shown in the lower left-hand corner of the engraving. The direct-current arc is used; the heat generated at the positive terminal is approximately 75% of the total heat generated in the arc. Either graphite or metallic electrodes may be used.

The Starting of

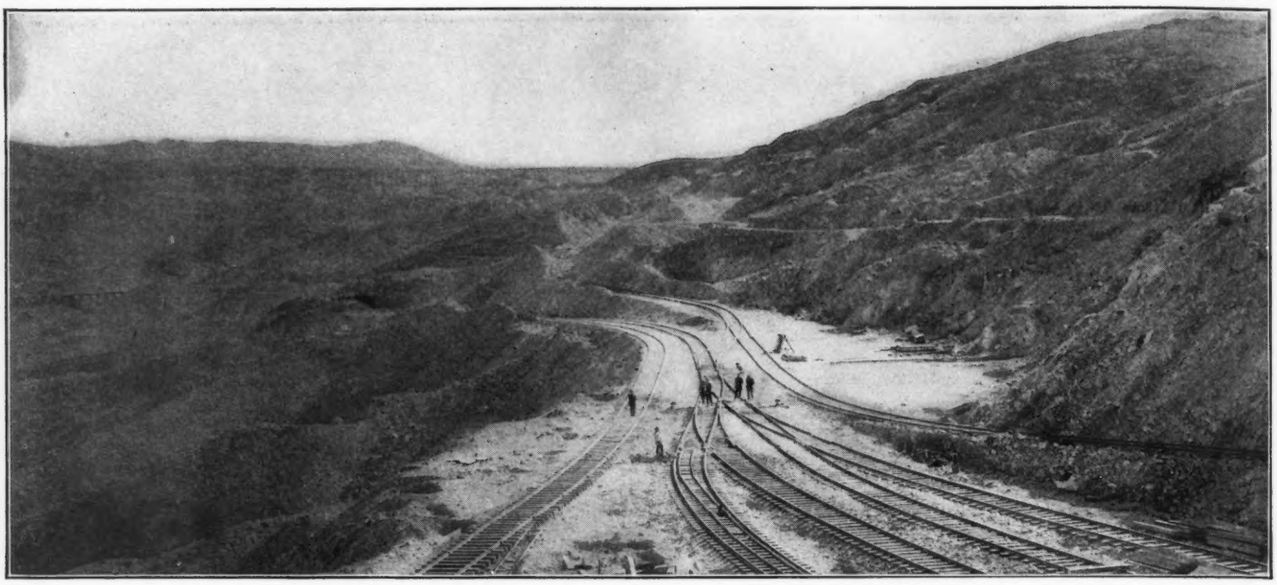
PANORAMA OF THE PROPERTY OF THE CHILE

One of the world's great copper mines is at Chuquicamata, in northern Chile, about 90 miles from the coast. It is Co. The latest estimates of the company's engineers show a total of 303,000,000 tons of developed ore, with reached, without, by any means, limiting still further possibilities. Roughly speaking, the orebody is about ore is about 635 ft., but 10 holes have reached a depth of over 1000 ft. and are still in ore. The ore is granodiorite min- depth. The above engravings present a continuous panora-

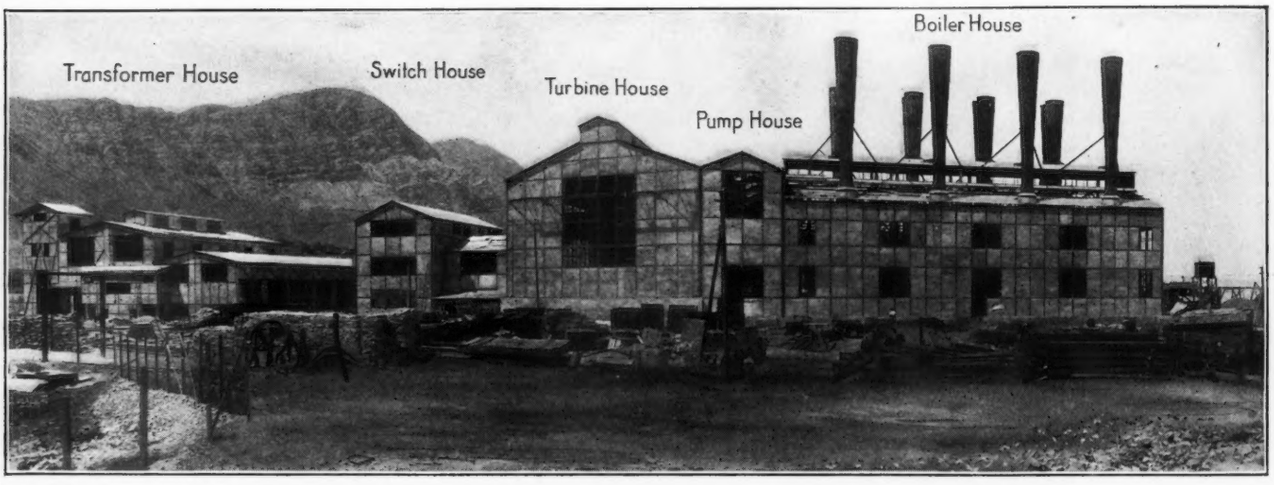
Chuquicamata

EXPLORATION CO. AT CHUQUICAMATA, CHILE

owned by the Chile Exploration Co., the operating company, all the stock of which is held by the Chile Copper
a mining average of 2% copper, and they believe that indications make certain that 400,000,000 tons will be
8000 ft. long and from 500 to 1500 ft. wide. It will be mined with steam shovels. The average thickness of the developed
eralized along cleavage planes. The chief copper-bearing mineral is brochantite. Sulphide ore of good grade occurs in
ma of the deposit and works of the company at Chuquicamata.

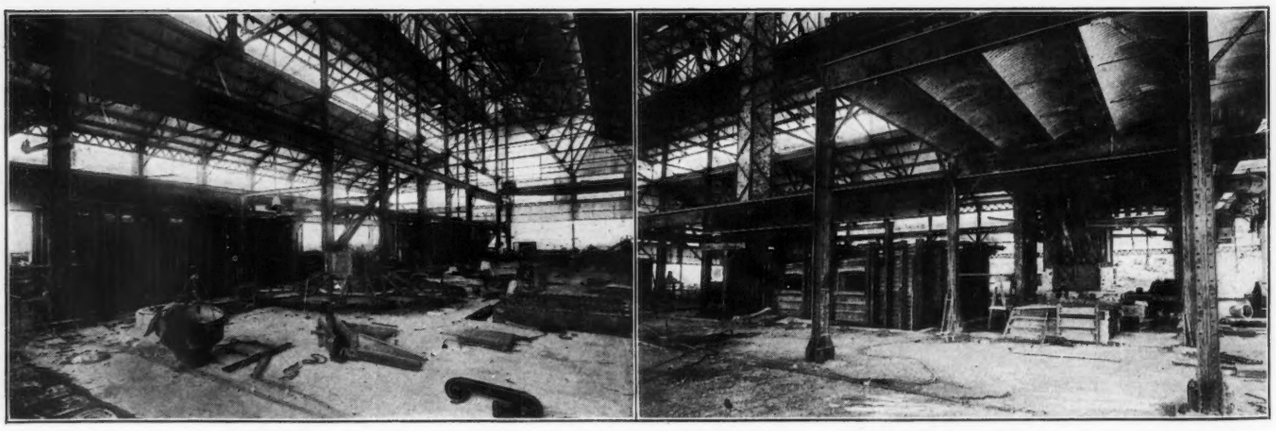


BENCH C, WHERE MINING BEGAN AT CHUQUICAMATA



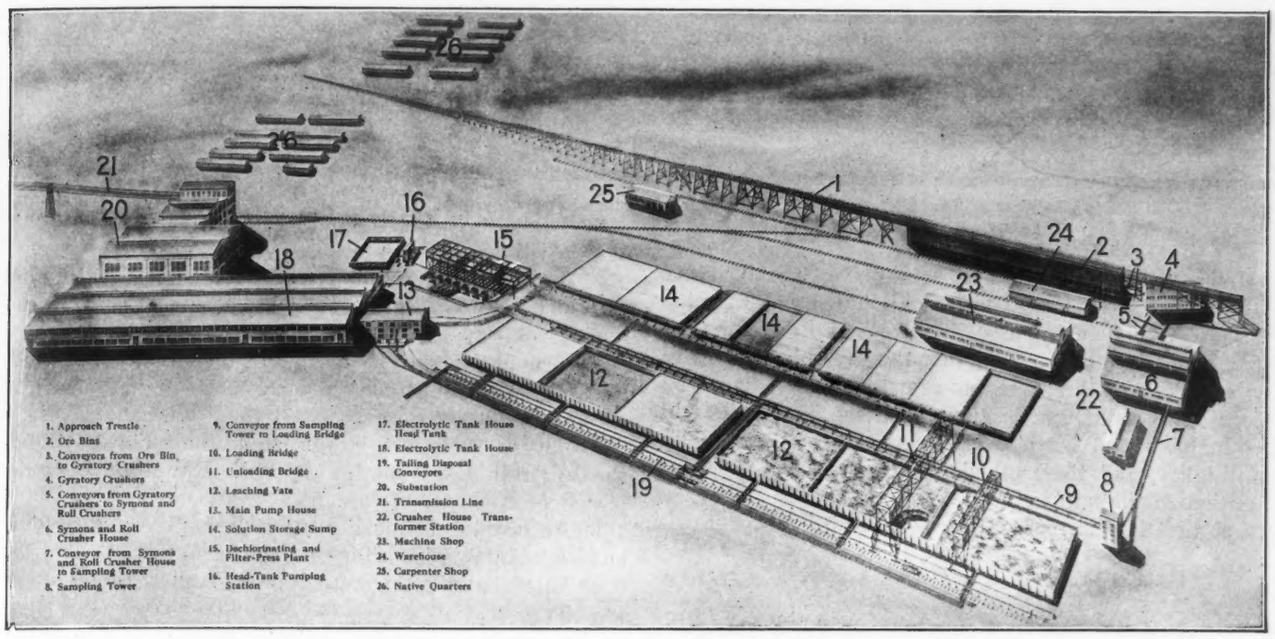
POWER PLANT OF THE CHILE EXPLORATION CO. AT THE PORT OF TOCOPILLA

From this 40,000-kw. power plant on the Pacific Coast power is sent to Chuquicamata, a distance of 86 miles, over a transmission line of No. 000 copper wire. The power plant comprises 16 Babcock & Wilcox water-tube boilers and four Zoelly steam turbines direct-connected to four Siemens generators of 10,000 kw. each. This equipment will give a spare unit of 10,000 kw. above the present power requirements of the reduction plant. At the outbreak of the European war much of the machinery for the power plant was en route on German ships, and this resulted in delay in the delivery of power at Chuquicamata. The power plant is designed so that either coal or oil may be used as fuel. Oil is used at present. The above photograph was taken on Mar. 1, 1915.



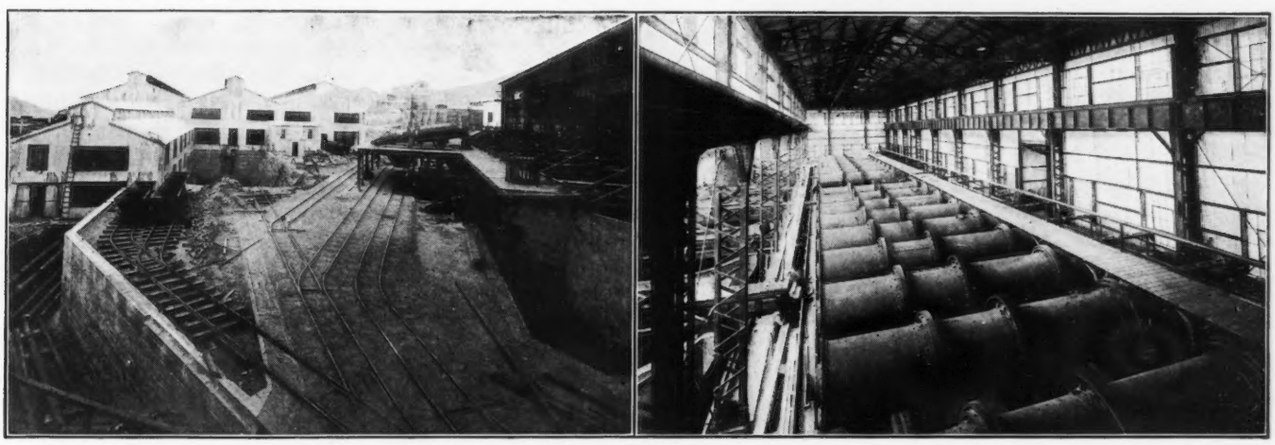
TWO VIEWS IN THE SMELTING AND MELTING PLANT AT CHUQUICAMATA

The reverberatory furnaces will be used for melting the cathodes produced in the electrolytic tank house. The cuprous chloride from the dechlorination plant will be smelted in the small blast furnace shown in the right-hand picture. These photographs were taken Mar. 22, 1915.


1. Approach Trestle
2. Ore Bins
3. Conveyors from Ore Bin to Gyratory Crushers
4. Gyratory Crushers
5. Conveyors from Gyratory Crushers to Symons and Roll Crushers
6. Symons and Roll Crusher House
7. Conveyor from Symons and Roll Crusher House to Sampling Tower
8. Sampling Tower
9. Conveyor from Sampling Tower to Loading Bridge
10. Loading Bridge
11. Unloading Bridge
12. Leaching Vats
13. Main Pump House
14. Solution Storage Sump
15. Dechlorinating and Filter-Press Plant
16. Head-Tank Pumping Station
17. Electrolytic Tank House Head Tank
18. Electrolytic Tank House
19. Tailing Disposal Conveyors
20. Substation
21. Transmission Line
22. Crusher House Transformer Station
23. Machine Shop
24. Warehouse
25. Carpenter Shop
26. Native Quarters

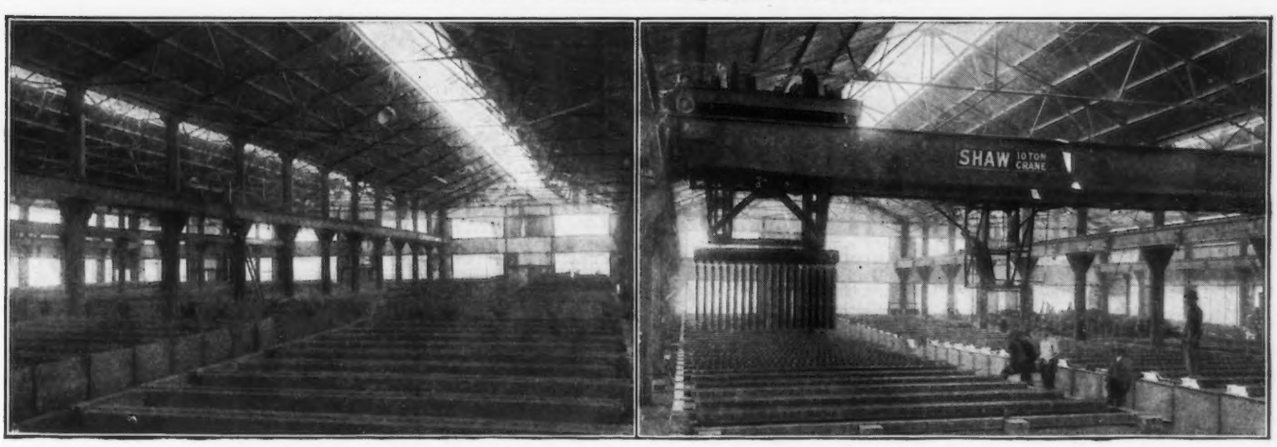
LEACHING PLANT OF THE CHILE EXPLORATION CO., WHICH STARTED ON MAY 18, 1915

Cable advice was received last week of the formal inauguration of the new leaching plant of the Chile Exploration Co. at Chuquicamata. The machinery was started by President Luce of Chile, who pressed a button at the presidential palace in Santiago, connection having been made over the government telegraph line. The present plant has a leaching capacity of 10,000 tons per day. Briefly, the plant comprises unloading bins, coarse-crushing plant, a fine-crushing plant containing disk crushers and rolls; six concrete leaching tanks, 110x150x16 ft., holding 10,000 tons each; solution tanks; dechlorinating plant, and an electrolytic tank house having a capacity of about 120,000,000 lb. per year.



THE PRECIPITATING AND DECHLORINATING DEPARTMENTS

On the left-hand side of the tracks is the electrolytic tank house; and on the right, the dechlorinating plant. An interior view of the dechlorinating plant is also shown.



TWO INTERIOR VIEWS IN THE ELECTROLYTIC TANK HOUSE AT CHUQUICAMATA

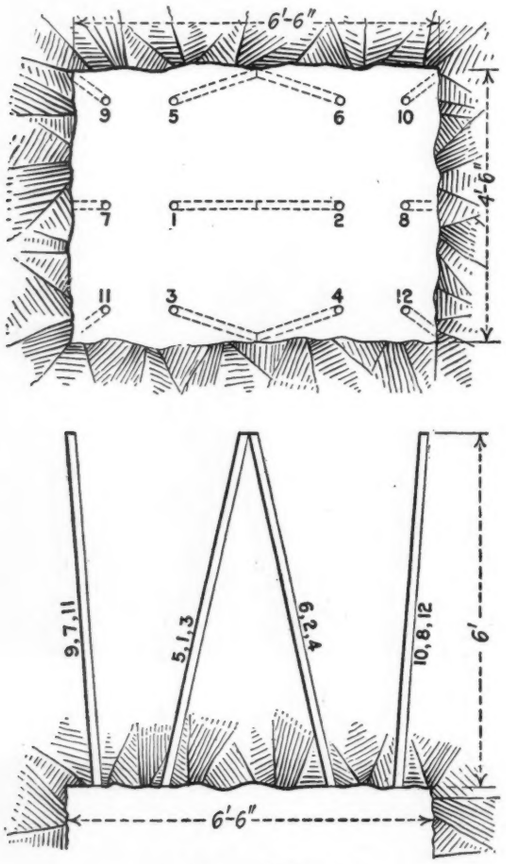
One of these pictures was taken on Sept. 21, 1914, and the other on Jan. 25, 1914. Over 88,000 magnetite anodes such as the electric crane is placing in the tanks are required for the present plant.

Correspondence and Discussion

The Five-Hole Cut

Under "Details of Practical Mining," in the JOURNAL of Mar. 27, H. H. Hodgkinson contributed a description of the old five-hole cut used in raising at Franklin Furnace, N. J. I did not know that the five-hole cut was in use anywhere at this time but supposed that it had been relegated to a dusty attic along with the hoop skirt and the high-wheeled bicycle. However, no one can claim infallibility, and the method may be justified.

Although the nature of the ground was not described, except that it was repeatedly called "soft," his methods



V-CUT FOR RAISES

and reasons seem questionable. A summary of his contribution reveals that seventeen 6-ft. holes, equivalent to 102 drill-feet, and more than 30 lb. of 50% gelatin are used in breaking only 125 cu.ft. of material where the drilling rate is 16 to 20 ft. per hour.

In my opinion the shape of the raise, 5x5 ft., should be modified to about 4½x6½ ft. for the following reasons:

1. It will break better because (a) the holes can be pointed to better advantage and (b) the arch of ground in the top of the raise will be weaker because of its greater length.

2. Twelve 6-ft. holes should be sufficient, saving 30% of the drilling cost.

3. A 5-ft. break would represent 146 cu.ft., 21 more then at present (advantageous when in ore, the reverse in waste).

4. The V-cut can be used and 14 lb. of 40% and 6 lb. of 60% gelatin should break 5 ft. or more, saving 30% of the blasting cost.

5. All the fuses may be ignited at the same time, and the less volume of powder gas will clear after a single period of waiting.

6. An opening of much greater economic value results, one having ample room for chute and manway.

7. Increased drilling speed because of greater working room.

The simple V-cut shown in the illustration herewith should break well at Franklin Furnace if the cut holes are so pointed that each one bottoms very close to the bottom of its fellow from the opposite end of the raise. The enormous charges of 50% gelatin now in use would seem to "overbalance" the resistance of the ground, and the object of using a less amount is, of course, with the purpose of exerting the disruptive force at the point of greatest resistance, namely, the bottoms of the holes. Emphasis may again be laid on the importance of heavy detonators and adequate stemming. The Bureau of Mines investigations reveal the fact that the drill holes at Franklin Furnace are not well tamped.*

The accompanying table shows the proper loading for the round:

Hole No.	Gelatin Sticks 40%	Gelatin Sticks 60%	Hole No.	Gelatin Sticks 40%	Gelatin Sticks 60%
1	4	1	8	4	2
2	4	1	9	3	2
3	3	1	10	3	2
4	3	1	11	3	2
5	3	1	12	3	2
6	3	1			
7	4	2	Totals..	40	18

In all holes put the 60% gelatin in the bottom.

H. A. MORRISON.

Dedrick, Calif., Apr. 5, 1915.

Bill McGinty, Prospector--II

Misther Editor—Well, we was stuck siv'ral hours at that Neveria place, Juan conductin' diplomatic relayshuns with the old lady in charge av the mule-waterin' concession jist the same as if it was the State Departmint at Washington an' him the invoy from some place.

Excelsior drifts along an' makes a motion to adjourn for the day, but I files a demurrer on the ground that we had not performed suffishent labor to hold a bedclaim—clinchin' me argymint by cinchin' me saddle.

Jist as the carga mules was ready, Rodrigo shows up with the missin' annymal, givin' away the saycrit av the moonshine still by his invious raymarks to Juan. We got away at 5 o'clock, ridin' hard enough to let Juan work off the iffects av the grape-juice substitoot, an' continuin'

*Bureau of Mines, "Bulletin 48," pp. 14-17 inclusive, and "Technical Paper 17."

by the light av the stars. As the brief twilight fell we did the same down a cutoff to Rio Chico, leavin' the wagon road entirely. *Chico* manes little, but there was no water at all. The day had been pretty hot, an' the ride in the cool av the evenin' was quite enjyable; but after losin' the trail wance we were glad to camp at Peñoles, near a village av charcoal-burners an' fuchure captains an' colonels.

The water obtained from a tiny pool in the bed av the rocky arroyo luks cloudy an' bad, but tastes cool an' sweet when ye're thirsty. Juan said three Ave Marias an' wan *carramba,* atonin' for a few hundred *carajos.*

In the mornin' I had to crack the ice in me enamel cup to take a drink an' a bath. The prodigal mule ate the balance av her husks an' cornstalks with relish an' competition; an' Excelsior an' I had fried swine bosom an' drank some milk we bought from the guardian av the lean calf that was double-crossed by the chairman av the house committee. Thus I became an innocent acces'ry before the facts that came afterwards. The proud patrishun that gazes contempsh'ly on the horny-handed, sun-burned sons av Moctezuma seldom realizes until too late what the nach'ral cunnin' that replaces book learnin' can do whin it begins to cultivate local patriotism instead av mescal thirst an' the patrishun's cornfields on unequal shares.

Givin' the committee a little more small change for the waterin' privilege an' for helpin' us page the mules, we rode down a beautiful park-like valley called San Xavier, an' then climbed to a broken, well-timbered mesa, which proved to be the Continental Divide in wan av its many twistin's in this region. Thin we follyed the Arenales River north for a while to see that no wan stole it. Whin it completes its grand circle by way av the Santiago to the Nazas it runs theoretically to the Gulf; but what the irrigash'nistas don't steal sinks into the ground in the Laguna district near Torreon.

Stoppin' for lunch jist before leavin' the stream, we were soon j'ined by a felly I had met at the hotel in Durango. He was from a ranch up in Idyho an' had come to Mexico to try dry farmin' an' maybe marry some rich Mexican girl. He got the girl later, but she was about as rich as his tungsten prospect. He was a "full-fledged minin' engineer," as one av' his frinds said, havin' complated a three months' corryspondinse coorse while herdin' sheep. It wud be an insult to ask him to show a sheepskin; but, anyhow, he must have had wan. Havin' heard that I had hoped to do a little prospectin' whin not engaged on business, he was kind enough to j'ine us at lunch an' give me all kinds av cheap advice on how to find a rich mine. I noticed him guardin' his *morral* pretty close, but whin I passed him me box av Flores de Balsa he loosened up an' confided that down the river, near Maguey, he had struck a rich dayposit av tungsten ore. "Luk at that sample, will ye," sez he, pourin' into me hand a lot av steely black scales. "She'll run 85 per cint. metallic tungsten, an' me forchune is made."

I was overwhelmed, indade. Here was me, still wearin' overalls, now an' then, an' there was a young felly about to buy a Ford, op'ry tickets, an' pink socks. Edicayshun is a great thing. I spits on me finger an' picks up a flake av the min'ral, stickin' it on me seegar near the ash. After a few hard puffs I opens me knife an' hold the tip av wan blade close to the ind av the seegar, an' the speck av semi-rejooced min'ral jumps to the knife like a flee to a dog. Then I takes a rock out av me pocket as an excuse for the knife an' begins to peck at it in a foolish way.

"What have ye there?" says the eddicated felly. Sez I: "'Tis a spicimin I picked up wan day, an' it has yellow specks in it like it was gold, maybe."

"Have ye tried the final test?" sez he. Says I, "'Tis too small for an assay."

"May the Lord forgive yer ign'rance," sez he. "The final test is to wiggle it in a strong light. If it stays bright an' yellow, 'tis gold; but if it's now ye see it an' now ye don't, 'tis fool's gold."

Sez I: "I understand the last part av the rule, for manny's the gold piece has slipped out av sight av the fool owner."

"Ye're right," sez he. "I've played poker against me own brother an' Hillman's crowd, an' that's why I came out here to prospect."

"Ah," sez I, "'tis the very name I've been tryin' to raymimber. Have ye iver run across a dayposit av *Hillmanite* or menaccynite?"

"I have not," sez he. "Have you? 'Tis rare an' vally'ble."

"Well," sez I, "I saw some not long ago, an' I think ye'll see it yersilf before *mañana* night, but I promise ye that ye'll hear about it whin the final test is made on the spicimins."

BILL MCGINTY.

Brooklyn, N. Y., May 10, 1915.

(Further Reminiscences Feared)

Mine Models Made of Celluloid

In the Apr. 24 issue of the JOURNAL was published my article, "Mine Models Made of Celluloid Sheets." I notice that a serious error was committed in the illustration, in that the drawing, in an important particular, was not reproduced as submitted. The draftsman altered the scheme, to suit himself, by introducing rods which fit through the tabs to hold them in place. This is an absurdity when compared with the method of support as described in the article itself. The method discussed is ample and sufficient to give stability and firmness to the structure, and required no revision or change. Emphasis was purposely laid upon the fact that this type of model needs no "extras" to give it strength and stability, and that in this feature it excels many other types of mine models now in use.

Madison, Wis., Apr. 28, 1915. MARK C. LAKE.

[This mistake occurred through a misinterpretation of notes on the original sketch submitted, and while regrettable, detracts in only a slight degree from the description. The moral is to make drawings so clear that they will not be misunderstood.—EDITOR.]

Heulandite in Oregon

Among some mineral samples sent in for identification I found a specimen of heulandite ($H_4CaAl_2Si_6O_{18} + 3H_2O$). As there is no record of this mineral having been found in Oregon before, I thought it would be interesting to publish this fact.

The mineral was found on Rowe River, one-half mile below Dorena, Lane County, Oregon. It occurred as a cavity lining in basalt.

GRAHAM J. MITCHELL.

Eugene, Oregon, May 4, 1915.

Mining Engineers Discuss Recommendations to N. Y. Constitutional Convention

The annual meeting of the New York Section of the American Institute of Mining Engineers was held at Machinery Club, New York, May 19. After the customary reports the following officers were elected for the ensuing year: Chairman, D. H. Browne; vice-chairman, J. H. Janeway; secretary, F. E. Peirce; treasurer, P. A. Mosman.

Following this meeting there was a joint meeting of the New York Section of the American Institute of Mining Engineers and the New York Section of the Mining and Metallurgical Society of America to consider the recommendations which should be made to the New York State Constitutional Convention. A committee of the A. I. M. E. had met several times with representatives of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Institute of Chemical Engineers, after the A. I. M. E. had been given power, through its directors, to take such action, and had done considerable work in formulating a plan of action to make certain recommendations to the delegates of the New York State Constitutional Convention. The directors of the Institute had, however, eventually referred the matter to the New York Section, with power to act as a section only.

Arthur S. Tuttle, of the Society of Civil Engineers, gave a general review of the relations that the united committee from the various societies found existed between the engineering profession and the state.

The engineering work of the state amounts to hundreds of millions of dollars per year, and the engineering payroll alone amounts to $6,000,000.

The matter before the meeting for consideration was, briefly, Should the New York Section of the A. I. M. E. join in recommendations to the State Constitutional Convention? The fear was expressed that evil would result to the profession if engineers got into politics. The answer was this was not a movement to inject the engineer into politics but to take engineering matters away from politicians and turn them over to engineers.

J. Parke Channing and B. B. Lawrence had been appointed a committee of representation, without authority, to sit with the other joint committee, and they collaborated with, and approved of the recommendations drawn by, that joint committee. It was the view of some of those present that it resolved itself into a question of the society voting confidence in these two of their members who had given much more time and study to the question than was possible for the average individual member. Mr. Channing disclaimed for himself and Mr. Lawrence any feeling in the matter, regardless of the following vote.

It was pointed out that this was not the first entry of the society into questions of political significance, as demonstrated by the rules for the operations for metal mines which were prepared by members for the Government and the decided though unofficial position taken by the societies on the apex question. Mr. Saunders here stated that he was authentically informed that the change in the apex law failed at the last Congress only because the change was not supported officially by the Institute.

After much interesting and enlightening discussion it was voted 25 to 11, and then made unanimous, to join the other engineering societies in this movement, and Messrs. Saunders, Channing and Lawrence were continued as a committee for the section, with power to act.

The Engineering Foundation Organizes

The gift of $250,000 by Ambrose Swazey, the Cleveland telescope builder, "for the benefit of mankind through fostering engineering research" has already been noted in the JOURNAL. Formal organization of the Foundation was carried through on Tuesday, May 25, at the Engineering Societies Building, 29 West 39th St., New York City, by the United Engineering Society, which represents the national organizations of electrical, mining and mechanical engineers, and is acting in coöperation with the national organization of civil engineers, the combined bodies having more than 30,000 members.

There are already on hand a large number of applications from those who wish the use of some of the funds for research work. On account of the number of applications and the incomplete form in which many of them were received, a schedule of requirements with which applicants will have to comply is being drawn up by the following committee, which was appointed to consider the applications: Dr. A. R. Ledoux, past president of the A. I. M. E., chairman; J. Waldo Smith, chief engineer of the Board of Water Supply, Gas and Electricity; Dr. M. I. Pupin, professor of electro-mechanics in Columbia University; Dr. Alexander C. Humphreys, president of Stevens Institute of Technology.

The members of the committee were chosen from the board which was selected at yesterday's meeting to administer the trust. Its other members are Edward D. Adams, banker; Gano Dunn, president of the J. G. White Engineering Corporation; Howard Elliott, president of the New York, New Haven & Hartford Railroad; Dr. Charles Warren Hunt, secretary of the American Society of Civil Engineers; Charles E. Scribner, chief engineer of the Western Electric Co.; Jesse M. Smith, past president of the A. S. M. E., and Benjamin B. Thayer, president of the Anaconda Copper Mining Co. The officers of the Foundation are Gano Dunn, chairman; Edward D. Adams, vice-chairman; F. R. Hutton. secretary, and Joseph Struthers, treasurer.

Ontario Mineral Production for First Quarter of 1915

The total value of the mineral production of Ontario during the first quarter of 1915 amounted to $7,312,370, as compared with $9,484,299 for the corresponding period last year, according to the Bureau of Mines. This total was divided as follows: Silver, $2,488,909; gold, $1,568,043; nickel, $1,496,622; pig iron, $1,158,462; copper, $526,338; iron ore, $50,592; cobalt and nickel oxides, $19,686; cobalt, $3718. The figures show gains in gold, nickel and iron ore as compared with the first quarter of 1914, but decreases in silver, copper, pig iron, cobalt, and cobalt and nickel oxides.

The gold was mainly the product of the Porcupine camp, where the Hollinger, Dome, McIntyre-Porcupine, Porcupine Crown, Vipond, Acme and Mines Leasing companies are now all turning out bullion. In other parts

of Ontario the producing mines were Canadian Exploration, Tough-Oakes and Cordova.

The number of mines marketing silver products, whether ore, concentrates or bullion, was 20. One large mine made no shipments during the quarter, and others produced more silver than they sold. Present low prices of silver offer no inducement to increase production, and the shortage of water for power purposes impeded mining and milling operations. Another cause of the falling off is the closing down or partial exhaustion of some properties which formerly produced freely.

The nickel-copper mines are working at high pressure. The Creighton mine is employing 750 men underground, and a seventh furnace is being put in at the Coppercliff smelting plant. At Coniston the Mond Nickel Co. is working every department at full capacity.

The Helen was the only iron mine making shipments during the quarter. The market for pig iron is depressed, and there will be a restricted output until a decided improvement is apparent in the demand.

The war has shut off all exports of cobalt or nickel oxide to the continent of Europe, where these materials, particularly the former, were in demand.

Raymond McCune Arrested

Raymond McCune, who for several years has been exploiting a Peruvian placer, was arrested on May 22 in New York on the charge of using the mails to defraud. The overt act on which the complaint was based was the mailing of a circular of the Peru Gold Placers, Inc., to J. A. Ellegood at the Equitable Building, Wilmington, Del.

Several years ago McCune returned from Peru, where he had been assisting his father in railroad building. He claimed to have found a remarkably rich gold placer and succeeded in interesting some wealthy men in New York, Wilmington, Del., and Springfield, Mass. The Peruvian Exploration Co. was formed, McCune receiving 49% of the stock and $51,000 being put in the treasury with which to make the preliminary examinations. As a result of glowing reports which McCune sent back, the "source of the fabulous wealth of the Incas" was assumed to have been found and the Peruvian Exploration Co., with its modest capital of $100,000, was deemed too small. Accordingly, the property was transferred to an operating company, the Marañon River Placers, Inc., all of the stock of which was held by the Peru Gold Placers, Inc. The directors of the latter company were: David T. Marvel, ex-Judge Supreme Court, Wilmington, Del.; Alexis I. du Pont, E. I. du Pont de Nemours Powder Co., Wilmington, Del.; John J. Raskob, E. I. du Pont de Nemours Powder Co., Wilmington, Del.; William R. Basset, Basset & Co., certified public accountants, New York; Otto R. Hartmann, importer, New York; Charles S. Miller, Miller, Franklin & Co., efficiency engineers, New York; Henry H. Bowman, president, Springfield National Bank, Springfield, Mass. The company was capitalized at $20,000,000 in 4,000,000 shares, 1,200,000 of which were placed in the treasury. On the strength of favorable reports submitted by Raymond McCune and his assistants, C. W. McHenry and A. J. Menard, 150,000 shares of the treasury stock were offered to the public at $2 per share.

Mining engineers generally were skeptical about the great profits estimated for this placer, but not until 1914 did the laymen directors became suspicious that all was not right. They accordingly sent an independent engineer, Frank R. Short, to the property, and as his report did not substantiate the earlier claims for the placer, the directors ordered the drilling discontinued and the equipment sold. The postal authorities here began an investigation, which culminated in McCune's arrest. The hearing has been set for June 12 and McCune released on $20,000 bail, which was furnished by the American Surety Co.

General Appraisers Considering Antimonial Compounds

The status for tariff purposes of antimony oxide or salts of antimony is about to be determined by the Board of General Appraisers. When the present tariff was made effective, the Treasury Department issued orders to collectors of customs to take duty at the rate of 25% ad valorem under the provision for "antimony oxide, salts, and compounds of." In a recent ruling, the board upset this classification, and held that the products are more fitly provided for at 15% ad valorem as "all chemical salts not specially provided for," according to the *Oil, Paint and Drug Reporter*. The Government did not take an appeal, but gave notice that a new test case will be made up, in which it is hoped the contention for the higher rate may be upheld. Meantime, collectors are directed to take the former rate of 25% on all importations.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

BUCKET. Herbert S. Atkinson, East Orange, N. J., assignor to The Hayward Co., New York, N. Y. (U. S. No. 1,138,614; May 11, 1915.)

CALCIUM CARBIDE—Multiple Carbide-Container. Augie L. Hansen, Chicago, Ill., assignor to Justrite Manufacturing Co., Chicago, Ill. (U. S. No. 1,137,755; May 4, 1915.)

CASTING—Method of and Apparatus for Continuous Casting. Grenville Mellen, East Orange, N. J., assignor to Continuous Casting Corporation, Richmond, Va. (U. S. Nos. 1,139,885 and 1,139,887; May 18, 1915.)

CASTING RODS—Apparatus for Making Rods and Tubes from Plastic Metal. Grenville Mellen, East Orange, N. J., assignor to Continuous Casting Corporation, Richmond, Va. (U. S. No. 1,139,884; May 18, 1915.)

COPPER ELECTROLYSIS—Process of Recovering Metals by Electrolysis. Lawrence Addicks, Douglas, Ariz. (U. S. No. 1,138,921; May 11, 1915.)

CRUSHING—Tube Mill. William B. Easton, Chicago, Ill. (U. S. No. 1,139,651; May 18, 1915.)

CRUSHING MILL. James D. Millar, Milwaukee, Wis., assignor to Edward F. McCool, Victor, Colo. (U. S. No. 1,139,790; May 18, 1915.)

DRILL—Rock Drill. William L. Smith, Chicago, Ill. (U. S. No. 1,139,139; May 11, 1915.)

FURNACE HEARTH. John H. Klepinger, Great Falls, Mont., and Frank R. Corwin, Douglas, Ariz. (U. S. No. 1,140,042; May 18, 1915.)

LADLE SKIMMER—Mechanical Ladle Skimmer and Heat Protector. Joseph Edward Fazakerley, Pittsfield, Mass. (U. S. No. 1,139,960; May 18, 1915.)

MELTING FURNACE Using Oil Fuel. William N. Best, New York, N. Y. (U. S. No. 1,137,378; Apr. 27, 1915.)

PHOSPHATE—Process of Producing Acid Mono-Calcium Phosphate. Robert Stewart, Logan, Utah. (U. S. No. 1,137,806; May 4, 1915.)

SEPARATOR. George Allen Fowler, Miami, Ariz., assignor to Crown Mill Equipment Co., Phoenix, Ariz. (U. S. No. 1,138,741; May 11, 1915.)

SMOKE—Apparatus for Neutralizing Corrosive Fumes in Gases. Thomas E. Murray and Edwin B. Ricketts, New York, N. Y. (U. S. No. 1,139,053; May 11, 1915.)

STEEL MANUFACTURE. Edward F. Kenney, Westmont Borough, Penn. (U. S. No. 1,137,144; Apr. 27, 1915.)

SULPHUR GASES—Process for Recovering Elemental Sulphur from Sulphur Gases. William Francis Lamoreaux and Charles William Renwick, Isabella, Tenn. (U. S. No. 1,140,310; May 18, 1915.)

Editorials

The Situation in Copper

The lull in the buying of copper which began about three weeks ago naturally caused a halt in the advance of price and then a recession from the high mark. No matter how satisfactorily the big producers may have contracted for the delivery of their expected output a long way ahead, there are always many small producers, not only in this country but also in Chile, Japan, and elsewhere, whose affairs are not so fortunately arranged, who are willing to sell for what they can get; and refiners buying cheap raw material are anxious to cover their purchases by sales of refined and in turn are willing to take what they can get.

The small recession in price that has lately been recorded does not indicate a serious turn of the tide, but merely, we think, that the excitement has faded away, which in our opinion is a fortunate development rather than the opposite. A resumption of military buying on a large scale may temporarily stir up things again, but in default of it the market ought to become quiet and steady at a little lower level, pending the development of new governing factors.

As for new governing factors, one may be foreseen certainly. That is increasing production. The mines have gradually been resuming full gait and about the end of June the refineries ought to be getting into step. Later in the year the new Inspiration and Chuquicamata copper will begin to be felt. A market factor whereof the development is earnestly hoped is increase in consumption for peaceful purposes, especially domestic. There are unmistakable signs of the beginning of this, and considering the riches that are coming to the United States it is hard to see how an expansion in our internal business is to be avoided. In so far as the copper trade is concerned, however, it would be better to make a start from a market at 16@17c. than from one that is over 20c., for the former is not an extravagant price and the latter is.

Whatever may happen, the copper producers will have no ground for complaint. They have sold a lot of their 1915 output at better than 18c., which is a very fine price, and they have reason to expect for a long time to receive a price well above what is commonly regarded as a normal average price.

At the close of this week there appear to be signs of a renewed demand for copper and there is a general expectation among producers that the market will rally and go above 19c., which of course remains to be seen.

The Minor Metals

The demand for some of the minor metals has been affected by the war, and the markets are very much disturbed. The most notable instance is antimony, which has gone up to nearly five times its price of a year ago, and is selling at all sorts of fancy prices. At present about all of our supplies are coming from the East—China and Japan—and the quantities are limited. Hungarian antimony is inaccessible. The finer brands, which we usually obtain from Great Britain, are hardly to be had, and the prospects are that their prices will go out of sight altogether. The high prices have led to a movement to utilize ores in America, and arrangements are being discussed to open the gold-antimony mines in Nova Scotia, which were worked some years ago, but without much success.

Nickel has been in strong demand and exports have been large. There has been little change in prices here, though the quotations abroad have advanced.

Aluminum has been quiet, although the considerable quantity imported has been nearly all cut off by embargoes and by demand abroad. Production here has increased and now seems quite able to meet current demands.

Quicksilver has been disturbed and erratic. The supplies coming normally to this market are those originating on the Pacific Coast and in Texas, besides which there are considerable receipts from Mexico which have not been greatly interrupted by the internal troubles of that unhappy country. The domestic production is much smaller than it was a few years ago, and bearing this in mind some of the producers are disposed to hold their output for pretty stiff prices; but when they are actually realized Italian quicksilver has been brought hither and then the market has generally declined again. Other producers would apparently like to see the market maintained on a basis that would not inspire importations, but in this as in all other things the law of supply and demand governs. The entrance of Italy into the war has now altered conditions.

War Notes

Recent military events in Europe have been of much mining and metallurgical interest. The Austro-Germans, pushing the Russians eastward in Galacia, have regained the petroleum wells in the vicinity of Drohobycz, Boryslaw and Potok, south of Przemysl. If they can hold them they will probably be relieved from their shortage of gasoline. The newspapers made much of the taking of Kielce, in Russian Poland, and a copper mine there. The Germans will not get much copper from that mine, which exists but is not of sufficient importance to be known statistically.

The great Austro-German victory in Galicia was apparently due to the massing of extraordinary artillery power and the throwing of millions of shells into the enemy's lines. This indicates how the great battles are to be fought and explains the insatiable demand of the Allies for copper and spelter wherewith to make ammunition. Trenches have heretofore been considered wellnigh impregnable, but if one side can concentrate enough cannon to obliterate the opposite trenches, of course no troops can remain where the ground is being plowed up under their feet.

While the Allies are having to buy so much copper, what are the Germans and Austrians doing for their sup-

ply? Communications from our own correspondent in Germany do not indicate any panic over that matter. Reports from other well-informed quarters are to the effect, however, that trolley wires are now being taken down for the sake of their copper, iron being substituted. It ought to be noted moreover, that the huge purchases by the Allies are to a large extent of copper that they anticipate using in the future rather than being a measure of their current requirements.

We have just received the report of the Mansfeld company for 1914. In form and substance this is exactly like its reports for previous years. There are but slight references in it to the war, and to our great surprise the production of copper by this company in 1914 fell a little short of its output in 1913.

The entrance of Italy into the war will simplify the matter of copper shipments from this country by removing one of the neutral countries over which friction has arisen. Now only Sweden and Norway remain. Recent communications by our Scandinavian correspondent indicate that a lively business in smuggling copper into Germany from Sweden and Norway has been going on.

New High Levels for Spelter

The further rise in spelter this week has brought the ordinary brands of this metal almost to the level of electrolytic copper, something whereof no one dreamed six months ago, and maybe spelter will go higher still. High-grade and intermediate already sell for more than 23c. per lb. This surprising event is due to the military demand—which pays no attention to price. The huge premiums realized for the superior grades of spelter have led many smelters to produce them—by redistillation—and the supply of ordinary brands is diminished correspondingly. The consumption of spelter for peaceful purposes is becoming paralyzed, but has not yet been so checked as to halt the advance in price. It will be interesting to see what will happen when the military buying ceases.

New York's Mineral Law

In connection with the proposals of the engineers with respect to the drafting of the new constitution for New York a committee was received by Hon. Elihu Root, chairman of the Constitutional Convention. Mr. Root expressed warm sympathy with most of the measures advocated, but pointed out that many of them were properly subjects for legislative action rather than what ought to be incorporated in a constitution.

Among the engineers' proposals there was scarcely anything of direct concern to mining engineers, but Doctor Raymond, in a communication to the board of directors of the A. I. M. E., made an important suggestion, namely, that an effort should now be made to abolish the state's sovereignty in certain minerals, which may conceivably be a cloud upon a title to real estate, and let all mineral deposits belong to the owner of the land, just as they do in most of the other states where the Federal land laws do not prevail, Missouri, for example.

This matter is probably of no great consequence in New York, inasmuch as deposits of gold and silver ore are unlikely to be discovered here; but that is no reason why advantage should not be taken of a good opportunity to eradicate an ancient reservation that is contrary to American ideas.

A New Step by the A. I. M. E.

A joint meeting of the New York sections of the A. I. M. E. and the M. M. S. A. was held a week ago to consider joining the other engineering societies in an effort to obtain the introduction in a new constitution for the State of New York, now being drafted at Albany, of features desired by engineers. While it was recognized that the program formulated by the other societies is good, the discussion was confined to the advisability of the mining societies joining them. It was recognized, moreover, that while the drafting of a New York constitution is primarily a local matter, it may properly be considered as one of national concern, inasmuch as other states may do the same thing, taking the New York constitution as a model.

The Mining and Metallurgical Society has not yet taken any action, being able to do so only as a whole, not through a section. The board of directors of the A. I. M. E. were in a position to take action by virtue of the recent amendments to the constitution of the Institute, but refused to do so and referred the question to the New York section with authority to act on its own account. Following a spirited debate, the New York section, by a vote of about 28 to 11, determined to go ahead.

This appears to have been a bungled business. The question itself was legitimate and the purpose was commendable. The Institute directors should have said "yes" or "no," we think. To evade the question and leave it to a section creates a bad precedent, which will be a plague hereafter. The right of action that was granted to the New York section will be claimed by other sections, and cannot fairly be refused; and sooner or later some section will take some action that will result in a schism in the Institute.

We surmise that the other big national societies will also have some things of a similar character to think about. If they are going to participate in public affairs they will have to arrange to do so in an orderly, deliberative way.

Specialization Overdone

So often have we been told that this age is one of specialization that we are beginning to believe it. In some ways we are sorry for it. There is, undoubtedly, such a thing as too much specialization. On the other hand, one may be so broadminded that by increasing the area too much the thickness may be reduced to the danger point. There is a happy medium to be sought in all things, and in nothing more than in mining engineering. Perennially we are regaled with the ancient admonition to skin our knuckles on the rocks and eschew yellow leggings and tall buildings. These advice-distributors fail to take into account the fact that the yellow-legged, tall-building dwellers usually have already gained honor through field work, having formerly sufficiently skinned their knuckles—and other parts of their bodies. It is not really necessary to maintain a permanently skinned condition to be efficient. The European war demonstrates that it is not necessary actually to point a gun by sight that the targets may be struck. A yellow-

legged, unskinned mathematician in a tall building, many miles away, may efficiently direct the pointing of that gun, knowing the range and the carrying power of the explosive he is going to use. So may a mining engineer know many things without being on the spot—and being subject to skinning. Skinned knuckles do not signify the high-class mining engineer, any more than a "cauliflower ear" denotes a fistic champion. Either may be acquired without proficiency. Practice is, of course, an essential to success; but there are other essentials to which attention must also be given. The prospective mining engineer should strive to acquire a diversity of accomplishment. By dint of persistent effort he may even acquire the art of writing grammatically. We should certainly advise him to do so.

BY THE WAY

The grade of the Goldfield Consolidated ores, as shown in the annual reports by the average amount recovered per ton, has fallen from $34.72 for the year ended 1909 to $11.61 for the year 1914. During the same period the total operating costs have been reduced from $9.63 to $6.02. High-grade ore discovered the latter part of last year has raised the average grade of the ore reserve above the average of a year ago. The amount blocked out is about 150,000 tons.

According to the New York *Evening Post,* N. Cushman, a mine owner, of San Diego, Calif., who returned May 6 on the steamship "Potsdam," said that when he was crossing the German boundary on his way to Rotterdam a search of his effects revealed two maps, which were confiscated. One was a map of Cripple Creek and the other of Hoboken, N. J. Mr. Cushman told the officer who took them that the Hoboken map might be useful, because that was where the German ships landed their passengers, but that he would not be likely to have use for the Cripple Creek map. To this the officer replied: "You never can tell."

Herewith is a tale that comes vouched for by *Mine, Quarry and Derrick*: "It was on a ranch adjoining the site of the Dingman Well, just after that well had been spudded in and when public interest was becoming marked. At that time we were all optimists and every acre of land in the vicinity was looked upon as potential oil land. I was as keen as any. In discussing with the rancher the possibility of his land covering a huge lake of oil, I got this startling pronouncement from him: 'My G——! You fellas in Calgary is crazy. Why, I've been on this land this 20 years and I've plowed and harrowed every rood of it, and I never seen any signs of oil.'" We rise to remark that we have seen statements much worse than this in alleged "reports" and prospectuses.

A subscriber to the JOURNAL requests that we publish weekly the quotations for manganese ore. We regret that it is impracticable so to do. The business in manganese ore is done almost entirely in long-time contracts, and what the terms will be cannot be determined until the contract has been negotiated. The negotiations of such contracts occur at rather infrequent intervals, and the terms are generally kept pretty close by the parties concerned. The business in many commodities more important than manganese ore—sulphuric acid, for example—is done in that way. It is impossible for any newspaper to give accurate wholesale quotations on them from week to week. The conditions are totally different from those obtaining in the market for the major metals, wherein there are transactions being made by a great many persons all the time.

The first requisite of any Safety-First operation is thinking capacity, and the more rapid and efficient the "thinks" are the better will be the results. According to the Cripple Creek *Times-Record,* John Laughlin's quick wit saved his life in the face of an explosion of 86 sticks of dynamite within 20 ft. of him. He lay flat on his stomach and hung his head and shoulders down a winze while the 19 holes went off.

Miners working on the same level of the C. K. & N., where the accident occurred, rushed to Laughlin's rescue when the smoke had cleared away. They were surprised to find him pawing his way out of the mass of rock that almost completely buried him. He walked unassisted to the shaft, rang for the cage and went to the surface. One of his shoes was blown off, the blast having severed his shoe laces.

Reported in New York

The stockholders of the Anaconda Copper Mining Co. have decided to reduce the number of shares in that company to one-half, the par value of the shares being increased correspondingly. This is a preliminary to the dissolution of the Amalgamated Copper Co., the stockholders of which are to receive Anaconda shares in exchange for their Amalgamated.

The extraordinary demand for high-grade and intermediate spelters for military purposes has inspired the inquiry whether such spelters are not being required for purposes for which superior grades are not really necessary. Of course the ammunition contractors who buy the spelter know nothing respecting this. They simply comply with the military specifications.

The evidence in the case of the Minerals Separation vs. Miami Copper Co. over the alleged infringement of flotation patents by the latter was fully presented during the week ended May 15, and last week the case was argued. Everybody is now awaiting the decision of the court with great interest. The evidence submitted in this case is understood to be the most exhaustive of any there has yet been presented in the litigation of the flotation patents.

The New York Trust Co. brought suit May 21 in the Federal District Court against the Canadian Venezuelan Ore Co., Ltd., and G. Fred Pearson, liquidator, to foreclose the $1,000,000 mortgage which the company had to secure its first-mortgage 15-year 6 per cent. bonds. Interest on the bonds, the complaint states, was defaulted on Jan. 1, 1914, and Jan. 1, 1915, and on Apr. 13 last $914,000 bonds were presented for payment unsuccessfully. The amount of the principal and interest now owing, it is claimed, is $1,118,314.

PERSONALS

R. B. Brinsmade spent April in touring Oaxaca, Mexico, looking for smelting ore.

Paul W. Gaebelein has been made superintendent of the new mill of the Baker Mines Co., of Cornucopia, Oregon.

Thomas Cantley, vice-president and general manager of Nova Scotia Steel Co., is on his way to Petrograd on business for the company.

Kirby Thomas is making examination of the South Lorrain district in the Cobalt region of Ontario; also of properties at Porcupine.

L. E. Plummer, a prominent Ottawa financier, is in Porcupine, Ont., looking over a group of claims in Tisdale township with a view to investment.

Noble W. Pirrie, assayer, of Vancouver, B. C., left that city Apr. 23 to take up a commission as a lieutenant of artillery, for active service in Europe.

C. W. Drysdale, of the Geological Survey of Canada, is expected to spend the field-work season of 1915 in British Columbia, probably in the Lillooet district.

Bradley Stoughton, secretary of the American Institute of Mining Engineers, was present May 21 at the meeting of the Southern California Section in Los Angeles.

E. M. Hamilton arrived from London May, 16, and left New York for San Francisco on the following day. His address will be Room 908, 625 Market St., San Francisco.

Ed. Dedolph, who was engaged in 1913 and 1914 in connection with the electric zinc smelting experiments carried on at McGill University, Montreal, and at Nelson, B. C., has arranged to open an assay office at Kaslo.

Walter W. Barnett, graduate of Colorado School of Mines, 1911, and recently assayer for the Wellington Mines Co., Breckenridge, Colo., has undertaken the duties of engineer and assayer for the Ellamar Mining Co., Ellamar, Alaska.

Myron T. Herrick, ex-governor of Ohio and former ambassador to France, has been in Colorado to attend annual meeting of Yak Mining, Milling & Tunnel Co., of which he is president. He addressed the Denver Chamber of Commerce.

S. Le Fevre, formerly general manager and mining engineer with Witherbee Sherman & Co., Inc., Mineville, N. Y., announces that his services are available as consulting and mining engineer. Permanent address, Forest Glen, Ulster Co., N. Y.; interviews by appointment in New York City.

A. L. Queneau, who has been serving with the Royal Engineers of the British Expeditionary Force since last December, wrote from the front, May 10, that he had just been through three weeks of the severest fighting of the war, but escaped unscathed though many times he thought that the next minute would be his last. Mr. Queneau was in the gas battle, when the French colonial troops suffered so badly and the day was saved by the Canadians. His opinion is that the gas used by the Germans was chlorine.

OBITUARY

Alfred Pels, of the firm of Siegfried Pels, of Hamburg, died on Apr. 2 after a short illness.

George Kopp, who entered the employ of the Quincy Copper Mining Co. when 12 years of age died at Hancock, Mich. last week, aged 52. He was mining captain in charge of work at No. 6 shaft of the Quincy.

John G. Morony died at Butte, Mont., May 23, aged 45 years. He was born in Montana and was interested in many banking and power companies. For several years he was managing director of the Amalgamated Copper Co. He was president of the Daly Trust Co., of Butte.

Andrew J. Reilly, Jr., died at Birmingham, Ala., May 18, aged 56 years. He was well known as a civil and mining engineer in Pennsylvania and Alabama. For a number of years he represented Birmingham in the Alabama State Legislature, where he was particularly active in securing the passage of the child labor bill.

John T. O'Brian, who died at New Orleans, Mar. 10, while on his way to South America, was an engineer and miner in California, but was best known for more than 15 years past in Colombia, where he developed some important mining enterprises. He made extensive explorations in that country and Venezuela, and was widely known and highly respected there.

Pierre Martin died in Paris, France, May 23. He was born in France and educated both practically and theoretically as a metallurgist, becoming a member of the firm of Martin Brothers. He devised the method of refining iron and making steel in the openhearth furnace, adopting the Siemens regenerative gas furnaces. The openhearth process is generally known in Europe as the Siemens-Martin steel process, in contrast to the bessemer or acid converter, and the Thomas-Gilchrist or basic converter processes.

Erik Johan Ljungberg, for years past a leader of the Swedish iron industry, died Apr. 5, aged 72 years. Born in the province of Västmanland he learned his profession by work at various iron plants and at the bergschule of Filipstad. He was engaged at various works and in 1875 entered the service of the Stora Kopparbergs Bergslag Aktiebolag, with which he had remained ever since. He rose gradually to have charge of the Domnavfet works; in 1888 he became a director of the company and since 1896 had been managing director. He was instrumental in introducing the concentration of iron ores and the use of the openhearth furnace in Sweden. He was looked up to as the foremost expert in the industry.

SOCIETIES

Colorado School of Mines commencement will occur Friday, May 28, at Golden. Dr. Lucien I. Blake, of Boston, will deliver the main address, having chosen for his subject "Epochs in Science." Following the graduation exercises there will be the usual reception at the Integral Club, a baseball game, and the very formal "Junior Prom."

American Institute of Mining Engineers—The Utah section of the Institute will hold a meeting at Tintic, July 15. To facilitate the work of the Tintic committee, an expression as to what the individual members wish to see has been asked for. It is aimed to procure admission to any of the mines, for any or all members, or to show them the camp in general in automobiles. If members are interested in any particular feature or in any particular mine, they are requested to communicate with J. H. McChrystal, Eureka, Utah, in order to facilitate matters. Walter Fitch is chairman of the committee.

American Mining Congress—The Utah chapter is working to increase its membership, and letters have ben sent to those likely to be interested. Attention is called to the fact that mining is the most important business in Utah. When the mines are active all other kinds of business share in the prosperity; when the mines are shut down or have curtailed their production, or when prospecting and development work are at a standstill, the whole state suffers depression. The Utah chapter has been organized to promote the welfare of mining, and to encourage the development of new properties. It is self governing, and will look after all local matters. The chapter's headquarters are 306 Boston Building, Salt Lake City.

American Institute of Chemical Engineers—This society will hold its annual meeting at San Francisco, Aug. 25 to 28, inclusive. An extensive program has been prepared. According to a tentative schedule the members will leave New York on Aug. 6 and arrive at Los Angeles on the 16, after stopping for several days at Chicago and the Grand Cañon. At Los Angeles there will be excursions and a joint session with the Southern California Section of the American Chemical Society. The party will leave Los Angeles Aug. 19 for San Francisco, taking side trips to points of interest along the route. Aug. 31 the members will leave San Francisco and travel to Portland by steamer, thence to Seattle, Butte and Anaconda. The return to New York includes a visit to Yellowstone Park and a four-day lake trip.

University of Kansas—A professional fraternity "Sigma Gamma Epsilon," devoted to the allied interests of mining, geology and metallurgy has been founded at the University of Kansas. It is proposed to establish chapters in the departments of Geology, Mining and Metallurgy in the leading universities and scientific schools of the United States and Canada. At present there is no such society extant. It is hoped the organization of such a professional fraternity among undergraduate students will promote a greater interest in the broad field of these allied sciences. The social as well as the scientific advancement of its members is provided for. The charter members of the society are: Dr. E. Haworth, State Geologist, Dr. W. E. Twenhofel, Associate Professor of Geology and Paleontology; R. A. Reynolds, H. E. Crum, H. R. Brown, W. E. Rohrer, C. B. Carpenter, G. L. Allen, S. F. Kelly and G. B. Sammons.

Editorial Correspondence

SAN FRANCISCO—May 21

Iliamna Volcano and an unidentified peak on the west coast of Cook Inlet, Alaska, are in eruption, according to reports brought by the steamer "Alamada" from Seward. Dense clouds of smoke were rolling up from the crater. Four slight earthquakes, accompanied by noise, have been felt at Seward during the last three months, but no shock was felt when the craters became active. Iliamna volcano, on the west coast of Cook Inlet, a peak 12,066 ft. high, has been known as an active volcano since the earliest records of the Spanish and American explorers, but its eruptions never have been violent. The district around Iliamna is virtually uninhabited.

Mount Lassen, the California Volcano, is again in eruption and has emitted such a flood of thick mud that many persons have had narrow escapes from death, and many farmers have virtually been ruined because their lands, formerly fertile, have been covered with from 4 to 6 ft. of "mud." Persistent reports are arriving of a red glow being visible on Lassen at night. The volcano is sending forth volumes of smoke and strong sulphuric fumes. No lava and no ashes are being thrown up, just unending mud. Incandescent ejecta rolling down the mountainside can be observed from Volta, 10 miles from Lassen Peak. The latest eruption means that the explosions are getting down into very hot mass and that the activity is more completely volcanic. Heretofore the ejected fragments blown out by the steam explosions were rarely red-hot.

First-Aid Applied to a case of serious accident at South Eureka mine, in Amador County, recently demonstrated the value of the training received by the class under the tutelage of the U. S. Bureau of Mines about a year ago. The foreman of the mine, T. J. Donovan, was making his rounds through the mine, coming up from the 2300 to the 2000 level, where he pointed out work to be done. His arm came in contact with a live electric wire. Donovan fell to the ground. The power was cut off and an Austrian miner, Mike Radovich, one of the first-aid class, set immediately to apply remedies. His assistants considered the case hopeless, but the Austrian, who had the added experience of army service, persisted, and Donovan's life was saved. Two years ago a like accident occurred at this mine, when scientific first-aid was not practiced, and the victim died from the injury. The teaching of the U. S. Bureau of Mines has been quite generally accepted at the larger mines in California.

DENVER—May 21

Consolidation of the Former Jack Pot and Doctor mining properties years ago brought about litigation of which a remnant has just shown up in a recent decision of the Colorado Supreme Court in reversing a decree of a district court in 1903. In this case, Josiah Winchester sued to recover $50,000 upon a bond executed by Herman Warne, H. L. Shepherd, W. F. Rock and J. Weicher. It is a very complicated case, involving title to 430,000 shares of stock in the Doctor-Jack Pot Mining Co.

Creation of Denver Headquarters for Prospectors is proposed by Theodore F. Van Wagenen, old-time, well-known mining engineer of Denver. Such an office would be supervised by an experienced mining man, familiar with Colorado and willing to devote reasonable investigation to every reported discovery. According to this proposal, professional mining engineers, donating their services and receiving only their cash expenditures, will render preliminary reports on each new prospect, and all properties thus found worthy will be offered to investors with the backing of this quasi clearing house.

Merger of Cripple Creek Mines is common talk. Scarcely had people become familiar with the recent consolidation of the Vindicator and Golden Cycle mining properties and the simultaneous merging of all other Milliken interests with holdings of the United Gold Mines Co., until they were informed that A. E. Carlton, leading factor in both the above deals, has now gone further and is endeavoring to effect a greater merger that will include the Vindicator, Golden Cycle, Cresson, Elkton, United Gold, Findlay and Trail mines and possibly one or two sampling works. At this writing, it is too early to report outcome of negotiations in progress.

Tungsten Purchasers' recent announcement of a substantial rise in the price of ore and concentrate has stimulated search for this metal of interesting physical properties. Among the concerns bidding for these materials are Wolf Tongue Mining Co., Primos Chemical Co., Boulder Tungsten Production Co., Colorado Tungsten Production Co., D. H. Smith, Eugene Stevens, Albert Lee Tungsten Mining Co. and S. D. Furlong. The present price of $8 for 60% WO_3 concentrate is expected to give way to an advance. The Wolf Tongue company carries classified "ads" in mining-camp newspapers offering 2-year leases on blocks of tungsten ground and it has also undertaken development work on company account.

Assessment of Metal-Mining Properties for taxation purpose is subject of criticism by county assessors holding state convention in Denver. Until this year, assessments have been upon a basis that worked injustice to metal miners by favoring agriculturists. It is possible that, in an effort to adjust the taxation burdens fairly, the law-makers in the last legislature went too far in favoring mining; but the probability is strong that this new disturbance was started by the farmers. At any rate, accusation is made that the new law permits the owner of a large, idle group of claims to pay no greater tax than is demanded of a prospector working a single claim. That there may be something really wrong in the law is indicated in the attitude of Assessor Ferril of Teller County (Cripple Creek district) who points out that the assessable valuation in his county has been reduced from $7,000,000 to $3,000,000, a basis that is insufficient to meet revenue demands. Assessors Hicks, of Dolores County, and Culley, of Clear Creek County, both primarily metal-mining regions, also claim shortcomings in the new law.

SALT LAKE CITY—May 21

Dividends Aggregating $394,500 were paid during April by three Park City mines, the Daly-Judge, Silver King Consolidated, and Silver King Coalition, and the Iron Blossom of Tintic.

The Salt Lake Stock & Mining Exchange during April traded in 2,040,603 shares of stock of a value of $463,655, as compared to 1,890,690 shares in March, of a value of $303,051. This is an increase of $160,000.

The Uranium Camps in Dry Valley will be active this summer. The Kearns company will spend $200,000 developing its holdings it is reported. The claims will be patented, and the ore being taken out will be stored until the marketing situation is more satisfactory. A concentrating mill will be installed by the company, probably this summer. H. H. Redd, who is interested in the company, has filed on a number of springs in Dry Valley. The water will be used for the concentration of uranium ores.

A New Producer has been added to the southwestern part of the camp of Bingham, in the Utah Metal & Tunnel Co. This company, which a short time ago completed its tunnel between Bingham and the Tooele side of the range, has produced in a small way from surface workings and through leases. The new ore, which is likely to prove of importance, was found in a raise from the tunnel near the Bingham end. It is a bedded deposit which has been opened for 30 ft. in thickness, with the extent on the strike and dip not determined, all faces being in ore. A car of ore is being shipped daily from material taken out in development. The ore averages 30% lead, 1.5% copper, 11 oz. silver, and 0.25 oz. gold, bringing net smelter returns in excess of $20 a ton. So far 18 cars, or about 900 tons, have been shipped. There is more gold than is usual in Bingham ores, resembling in this respect some of the ore from the adjoining Highland Boy, and Bingham-New Haven properties in this section. The gold is associated with the pyrite, and the ore is entirely sulphide. New assay office equipment has been sent to the property.

SEATTLE—May 20

The First Cleanup of 1915 in the Fairbanks District was brought into that city Apr. 30 from Eva Creek, where it was sluiced out on the Alfred Hendrickson property. Eva Creek is a tributary of Ester Creek. This is a much-sought distinction in the district each year, and Hendrickson was hailed with delight when he brought in his poke. This is only a forerunner of the hundreds of others which will soon begin to "throw gold" and will soon be keeping the assay office fur-

naces going overtime to melt the first shipment for the outside, which is expected to be made up much earlier this year than last on account of the early breakup on the creeks. The placer mining season in this district is just 23 days ahead of last year, and because of the early start there is not an operator in the Fairbanks country who does not predict a larger production this season than in 1914. More ground is being worked, and while much of the new ground has not been proved up, early returns from the different discoveries indicate that new ground will go a long way to swelling the total. The Tolovana is expected to prove one of the biggest producers of the really new ground. This creek has shown more in the first few months since its discovery than the whole Fairbanks district produced in its first year. Sluicing is general in this district from Hot Springs, Tenderfoot and Circle. On Cleary Creek and Wolf Creek there are seven outfits sluicing and others are expected to start in a few days. On Ester Creek, Hendrickson & Dahl, Webber & Co., Leedy & Stay, George Roy, Sullivan & Olson and a few others are sluicing. On Pedro Creek it is expected two or three outfits will be sluicing within a few days. On Fairbanks Creek a number of small outfits are sluicing now. Old-timers report that with the new ground discovered and being worked and old properties showing up so well, prospects for a prosperous season were never more surely indicated.

ISHPEMING, MICH.—May 22

The Bill Repealing the Holland Law, which provided for separate taxation of mineral rights and reservations, apart from the fee has been signed by Governor Ferris. The bill not only repeals the taxing measure but it provides that the auditor general shall return all sums paid to the state on the enforced sales. The suits brought by Michigan mining companies to secure a determination as to the constitutionality of the old law, and to restrain the state from collecting the taxes on mineral reservations, will be dropped. Taxes that were paid in voluntarily, however, will remain in the state treasury. The state is saved money by the bill as it would cost in the neighborhood of $100,000 for the abstracts required in the auditor general's office. The taxes produced no additional revenue for the state as the valuation of the mineral right was deducted from the previous assessments, when both fee and mineral rights were lumped as the elements of value.

Foreclosure Suit against the Lake Superior Iron & Chemical Co. has been won by the Union Trust Co. of Chicago, and the defendant company must pay the sum of $7,462,851.53 on a specified date, with interest at 6%, in default of which the holdings of the company are to be sold by the special master in chancery appointed. The company was bonded by the Union Trust Co. for $6,000,000 several years ago, and the foreclosure suit was commenced in the fall of 1913. Co-defendants with the Lake Superior Iron & Chemical Co. are the Continental & Commercial Trust & Savings bank and Frank H. Jones. The case was not contested by the defendants. The decree provides that any of the parties of the suit may become the purchaser, or purchasers, of the company's property. All bids for the purchase of the property must be accompanied by a certified check for $100,000. The Lake Superior Iron & Chemical Co. has extensive holdings in Michigan and Wisconsin. It has blast furnaces at Newberry, Chocolay and Manistique, in the upper peninsula, Boyne City and Elk Rapids, in the lower peninsula, and at Ashland, in Wisconsin. In addition to the furnaces, the company has large timber holdings in the two states, and an interest in the Yale mine on the Gogebic range. The Boyne City and Newberry plants are the only ones in operation at the present time.

BRAINERD, MINN.—May 22

The 1915 Season on the Cuyuna Range is characterized by activity in stripping at those portions of the range with shallow overburden, and, contrawise, the underground mines with few exceptions are idle, or nearly so. Stripping operations are under way at the Thompson, Armour No. 1, Hill Crest, Rowe, Pennington and Mahnomen properties. Underground development work is going forward at the Croft, Iron Mountain and Brainerd-Cuyuna, while the following properties are shipping: Armour No. 2, Kennedy, Wilcox and Thompson. The idle list includes Cuyuna-Duluth, Cuyuna-Mille Lacs, Adams, Duluth-Brainerd, Barrows and Meacham.

DULUTH—May 22

A New Loading Record was made at the Duluth, Missabe & Northern docks this week. Ten boats were loaded in one 10-hr. shift. The amount of ore which left the pockets totaled 86,000 tons. During the same time 1213 cars were unloaded into the ore pockets. Shipping is quite brisk from the Mesabi range and it is believed that the May shipments will be ahead of last year.

SAN ANTONIO—May 20

American Mine Owners Having Properties in Mexico have been much disturbed over the prospects of practical confiscation through the threatened enforcement of a decree issued recently, by General Francisco Villa which imposed requirements upon them with which they are unable to comply. Congressman James L. Slayden of San Antonio interested himself, on behalf of a number of his constituents who own mines in that country, to have the decree abrogated or modified. He took the matter up with the Department of State at Washington and is just in receipt of a letter from Robert Lansing, counselor of the Department of State in which he says: "Under date of Apr. 14, 1915, Mr. George C. Carothers, a special representative of the Department of State, was telegraphically instructed to protest against the application of the provisions of this decree to American mine owners. A telegraphic reply has been received from Mr. Carothers saying that he is informed that it is not the intention of the authorities who promulgated this decree to injure legitimate mining industries, but to prevent the purchase of dormant mining property by speculators for profit. Mr. Carothers added that it was his intention to proceed to Chihuahua as soon as possible and discuss with the appropriate authorities the matter of changing or modifying the decree, and he recommended that American mine owners make immediate representations to the Minister of Fomento, in Chihuahua, and procure exemption if justified, as provided in the decree."

TORONTO—May 24

The Establishment of a Copper Refinery in Canada is likely in view of the great demand for shells caused by the war, the orders for which to date given to Canadian manufacturers amount to $154,000,000. Owing to the prevailing high prices for the copper, brass and zinc, all of which required for shell-making purposes have to be imported, the Canadian Government has been considering the question as to whether the manufacture of these metals in Canada would be economically expedient. An expert of the Internal Revenue Department and a professor of McGill University, who were commissioned to go to British Columbia and study the problem, have reported that a bounty of 2c. per lb. on copper would enable a copper-refining plant to be successfully established, and that the cost would speedily be made up by the saving in the price of materials for war orders.

CHRISTIANIA—May 1

Norwegian Nickel Mines at Skjaekerdalen are, it is stated, being unwatered with a view to reopening. They were shut down about 20 yr. ago.

Iron Ore Find in Sweden—A Swedish engineer, Wilh. G. Thisel, has registered a large iron-ore area between Vittangi River and Kunsivaara, probably a continuation of the Svappavara deposit. The ore does not outcrop and the claims are stated to be based solely on magnetometric measurement.

Underground Miners' Restaurant—In the Karl Johan shaft of the Swedish iron mines at Grängesberg, and at a depth of 170 yd., a saloon is being constructed for the sale of refreshments to the men as well as for meals during the usual intervals. The room, which will be about 17 yd. in length by 6½ yd. in breadth, will be lighted and, presumably, warmed by electricity.

An Embargo has been placed by the German military authorities upon certain of the rarer metals, such as tungsten, chrome, vanadium, molybdenum and manganese, used in the manufacture of implements of war. Owners of and dealers in such metals have to give notice to the War Office of their supplies in hand up to Mar. 16 and every three months thereafter under penalty of imprisonment for one year for each contravention.

Christianssand Nickel Refinery—On Jan. 2, 1914, the Christianssand Nickel Refinery, Norway, substituted basic converters for the Garherd and flame furnaces hitherto used. During the year there were smelted 28,521 tons of ore from the Flaadt mine, 2053 tons from the Faerö mine and 1991 tons from Greece. There were produced 955,675 tons matte, refined to 481,353 kg. nickel and 276,798 kg. copper.

No Want of Old Metal—In response to its admonition for economy in saving up scrap metal from which the valuable parts might be extracted for the exigencies of war, the German War Office has been overwhelmed with offers of household implements and even of church bells usuable for such purposes. Acknowledging the patriotic interest evinced by all classes of the people, the Minister of War publishes his thanks through the press, at the same time notifying that there will be no lack of old material to draw on.

The Mining News

ALASKA

HOT SPRINGS DISTRICT will employ 500 or 600 men this summer and expects to produce more than a million, thereby breaking all previous records.

OUTLOOK IN KOYUKUK is brighter since recent discovery of rich pay by several operators. On No. 4 Below, Hammond River, Nelson & Smith obtained $1632 in single pan of gravel. Their "pickings" for six days averaged more than $1000 per day. Kelly & Grogan, on nearby claim, picked up $4000 in six days. Hastings & Hoosier, on Hoosier Association claim, have found many $100 pans. Wool & Co. on No. 5 Nolan Creek, picked up $500 in one day, and Hansen & Christensen on same creek $600 in one day. The Koyukuk is noted for irregularity of pay and exceeding richness of some spots; it often happens in taking out winter dumps that half of total yield is recovered as nuggets and rich pans before sluicing.

CANYON CREEK (Fairbanks)—E. Canyon has found $1.50 ground at depth of 87 ft. on Cañon Creek, tributary of Healy River.

KENAI RIVER has been decided by government officials to be navigable stream, which means that all people can now mine within 60 ft. of high-water mark, same as on beach.

KNIK QUARTZ MINES, which produced nearly $300,000 in 1914, expect to increase their output this year. Alaska Free Gold produced $153,000 last year, Independence $18,000, and Gold Bullion $125,000.

FAIRBANKS TELEPHONE CO. (Fairbanks)—Fairbanks Telephone Co. plans to extend its line to newly discovered Tolovana district. Line will follow summer trail. Total distance from Fairbanks is 55 miles.

ALASKA GOLD (Juneau)—During April broke 106,986 tons ore and trammed 61,912 tons to oreways. Railroad handled 57,000 tons which mill treated. Construction and equipment of other sections of mill being aggressively pushed.

NO. 2 ABOVE DISCOVERY (Dome Creek, Fairbanks)—New pay running $2 per sq.ft. reported discovered recently by Nerland Bros. on claim No. 2 Above, Dome Creek. Johnson & Co. have also found pay on 6 Below, right-limit bench.

STEVENS-O'CONNOR (Fairbanks)—Stephens, Kleinschmidt & Boyd are mining 16 tons of ore per day from their lease on Stevens-O'Connor property on right limit of Fairbanks Creek. Vein is 12 ft. wide. Ore will be milled at Heilig custom mill.

ELK CREEK (Ruby)—Considerable excitement caused at Ruby by recent strike on Elk Creek, in Lone Mountain district, 27 miles southwest of Poorman. Ground is 50 to 75 ft. to bedrock; O'Connor & O'Melia have obtained pans carrying from 40 to 75c. at bottom of their shaft.

NO. 1 ABOVE (Ester Creek, Fairbanks)—Sluicing in Fairbanks district started by Webber & Co. on No. 1 above Discovery, Ester Creek, on Apr. 11, probably earliest in history of camp. Barker & Hendrickson, on Eva, who started sluicing about same time, made first cleanup of season.

ARIZONA

Cochise County

COPPER QUEEN (Bisbee)—Increased price of copper gained for 6000 employees at mines and smeltery at Douglas average wage increase of 8%.

CALUMET & ARIZONA (Bisbee)—Organization of railway company to connect with New Cornelia completed. Officials include Calumet & Arizona and E. P. & S. W. and Rock Island people. Survey completed. Charles Briggs, president of Calumet & Arizona, is president of new railway company. Bids are asked for construction of railroad 38 miles in length from the railroad at Gila Bend south to point near Ajo. All bids to be in office of general manager John C. Greenway, at Warren, by noon, June 10. Plans, profiles and specifications can be had by applying to R. H. Jones, chief engineer, Gila Bend, Ariz.

Gila County

CHAMPION (Globe)—Col. J. A. Flemming has taken 3-year lease on Champion mine 15 miles from Globe. Property was producer in early days.

INTERNATIONAL SMELTERY (Miami)—No. 1 reverberatory was filled with calcines morning of May 17. In anticipation of matte two stands of converters and one of the two casting receivers are being warmed up.

COLE-GOODWIN (Miami)—Development work shows better results daily. With advent of better equipment and larger working force for which management is now arranging, will probably show up well among copper prospects of this district.

PATRICK P. SULLIVAN, one of well-known mining men in Globe and Miami districts, and his coöwners in group of 22 claims that adjoin Inspiration and Warrior properties are contemplating churn-drilling their ground. They expect to tap Black Warrior ore dipping west.

WARRIOR COPPER (Black Warrior)—Title to property of Warrior Copper cleared and directors of that corporation, together with reorganization committee of old Black Warrior Copper Co., vindicated of all charges of fraud in Superior Court at Globe. Case before courts since early in 1909. Final settlement expected to aid in resumption of activities at Warrior. Property being worked at present under lease to Fisk, Snell & Wilson.

Greenlee County

TWIN PEAKS (Duncan)—E. A. Wayne of El Paso has purchased Twin Peaks property 25 miles northeast of Duncan. David Gough of El Paso is associated with Mr. Wayne. The Gold Strike which adjoins the Twin Peaks is included in transaction.

Maricopa County

PITTSBURGH TUNGSTEN (Cave Creek)—Active development continues on this property north of Cave Creek. Concentrator installation contemplated.

GEORGE U. YOUNG (Phoenix)—Plans to build new reduction mill at his mine, situated 16 miles north of Mesa. Mine is low-grade gold proposition. Present mill and cyanide plant upon property has capacity of 40 tons daily.

Pinal County

A. B. C. (Wooley)—Property being examined for Eastern capitalists who expect to start work in June.

Yavapai County

GRIJALVA (Wickenburg)—Property being sampled. Owing to nature of ore 4-ton samples are being taken.

UNITED VERDE (Clarksville)—Blowing in of new smeltery took place few days ago. Former Senator W. A. Clark, of Montana, was present.

COPPER CHIEF (Jerome)—Has started work on 125-ton cyanide plant, consisting of crushers, ball mill, tube mill, Dorr agitators and thickeners, Oliver filters and Merrill press. Will treat 175,000 tons leached surface ore assaying $10 gold and practically no copper. Plant expected to be in operation in September.

Yuma County

BIG DIPPER (Mohawk)—George W. Norton, who has a bond on the Big Dipper, recently opened up high-grade gold ore.

CALIFORNIA

Amador County

ORIGINAL AMADOR (Amador City)—About 50 property (townsite) owners have been made parties defendant in suit to quiet title. Property is covered by mining locations known as Eclipse, Eclipse Extension and Last Chance quartz mines. Company contends that its mining titles are paramount to townsite titles, but has offered deeds to surface rights which townsite holders are reported to have accepted. So there may be no serious legal contention, residents of the town will remain undisturbed and mining company be enabled to develop and mine orebodies extending beneath town.

ARGONAUT (Jackson)—Preparations being made for deepening shaft to 6000-ft. point. Station has been cut on 3900 level for installation of electric hoist. Shaft is now down 4200-ft. on incline and is deepest inclined excavation on Mother Lode. Coincident with hoist installation, removal and enlargement of 40-stamp mill will be in progress. These improvements were contemplated some time ago, but have been delayed by apex litigation brought by Kennedy Extension. Although case has been appealed to Supreme Court from lower court's decision in favor of Argonaut there is prospect that the matter will be adjusted out of court and save possibility of retrial.

Calaveras County

PIONEER CHIEF (San Andreas)—Preparations being made for installation of machinery and reopening this mine formerly known as Thorn. J. E. King is superintendent.

FINNEGAN EXTENSION & FINNEGAN (Carson Hill)—Both properties taken over by Carson-Calaveras Mining Co. Will add 10 stamps to 10-stamp mill and install cyanide plant. R. H. Toll, superintendent.

Nevada County

UNION HILL (Grass Valley)—Rich shoot of ore encountered in the raise from 800 level. Quartz is 15 in. wide. Second shot broke into volume of water and pumps necessary to clear level before resuming work in raise. This shoot of ore extends from winze in 600 level. Shaft will be deepened to 1200 ft. Expected mill will start at early date.

Shasta County

BRIGHT STAR (Stella)—Sinking shaft to 170-ft. point is in progress. Installation of stamp mill this summer is contemplated.

DELTA CONSOLIDATED (Redding)—Installation of modern stamp mill contemplated at this property on Dog Creek. S. D. Furber is secretary.

OSWALD (Knob)—Andrew Oswald, for many years superintendent of Midas mine in Harrison gulch, has resumed development of property adjoining Midas, located on same vein system.

MOUNTAIN COPPER (Keswick)—Shipment of ores and concentrates to smeltery at Martinez delayed by damage from heavy rains. Bridges, trestles and other surface equipment washed out. Reported that more than 100 in. of rain fell in 36 hours. Storm did great damage in various parts of copper belt.

COLORADO

Boulder County

KEYSTONE (Boulder)—C. A. Staley is reopening this pioneer mine after its inactivity for 12 years by sinking new shaft through old stopes to 400 level and thence through new ground to 600 level.

Dolores County

HIAWATHA (Rico)—Hays & Herron, leasing through Group adit, have opened 10-in. vein assaying 30% lead, 5 oz. gold and 900 oz. silver. First shipment just made to Durango smeltery.

PRO PATRIA (Rico)—Leasers Shelhamer & Batchlor make semiweekly express shipments to Durango of 100 to 200 lb., running about $15 per lb. exclusively in free gold. They save ore from which this stuff is selected and will soon ship carload.

Lake County

ST. LOUIS (Leadville)—During April shipments amounted to 75 tons averaging about $20 per ton.

PENROSE (Leadville)—Water has been lowered 70 ft. in shaft past week by new electric pumps after they were overhauled and somewhat altered to remedy defects that developed in initial runs. Pumps are suspended in separate compartments and are run intermittently, each pump being shut down while its column is lengthened.

Ouray County

CAMP BIRD (Ouray)—During March mine produced 2290 tons ore. Net profit was $36,000 or $15.72 per ton.

San Juan County

KITTIMAC MILL (Eureka)—Several carloads machinery for new mill arrived at Silverton. Will be freighted to mill site as soon as weather conditions permit.

WILFLEY MEARS (Silverton)—Tailings enterprise again under way. Flume which gave them so much trouble last fall in cutting out quickly is to be lined with vitrified tile. This is expected to overcome excessive wear of tailings transported.

AMERICAN OIL FLOTATION CO. (Silverton)—Silver Lake mill, recently leased, is being remodeled under direction of D. L. Thomas to suit oil-flotation process. At Champion mine, on Sultan Mountain, this company is placing property in shape to supply 50 tons of sulphide ore per day to mill.

San Miguel County

TELLURIDE SHIPMENTS OF ORE AND CONCENTRATE during April established a record. Concentrate was shipped from four largest mines in carload lots as follows: Liberty Bell, 11; Tomboy, 50; Smuggler Union, 25; Black Bear, 20. Approximately half the valuable metals in the ores from these mines is recovered by plate amalgamation before concentration.

Teller County

DEAD PINE (Altman)—Dump leasers Powell & Lee, marketing $12-stuff, will install washers.

GOLD DOLLAR (Cripple Creek)—A. J. Campbell, managing Beacon Leasing Co., has opened 4-ft. vein at foot of 127-ft. winze sunk from 1300 level of Mabel M. shaft, on Beacon Hill.

MARY McKINNEY (Anaconda)—Mine is shut down 10 days during installation of new electric-driven compressor that will provide for larger operations. Main shaft will be sunk 200 ft.

BLUE BIRD (Altman)—In Franklin lease, 1500 level, extremely rich sylvanite ore has been found in raise 600 ft. south of main shaft. There are three parallel vuggy streaks in a 5-ft. vein.

AJAX (Victor)—On 400 level, leasers Worthington & Downer have developed 100 ft. along high-grade shoot in supposed hanging wall. Are shipping 10-oz. ore. Shoot is 9 ft. thick. Similar ore also found in 1200 level.

ECONOMIC (Victor)—Tramway and 100-ton orehouse for handling dump at mouth of old Gold Coin adit to railroad point are completed. Estimated that 100,000 tons will be shipped and cyanided.

LAST DOLLAR (Victor)—On 1200 level, leasers Gibbons & Crumby opened 4½ ft. of 3-oz. ore. Hereafter compressed air for drilling in this mine will be piped from Logan mine plant. Main shaft will be sunk from its present depth of 1400 ft.

GOLDEN CYCLE-VINDICATOR (Goldfield)—In both mines leasers are producing heavily. E. Soran is washing a Vindicator dump and marketing fines running 3 to 4 oz. per ton. Company will soon begin erection of $10,000 boarding and club house for employes and officials.

ELKTON (Elkton)—John Sharp maintains shipments of 1-oz. ore from mine dump. Regular 2% quarterly dividend paid on May 24; 1915 distributions of profits amounting to $100,000. To date mine has paid to stockholders $3,547,460. All ore now goes to Golden Cycle mill, Colorado City, for treatment.

IDAHO

Bonner County

KEYSTONE MINES CORPORATION (Sagle) — Three-fourths interest in the Keystone group having 43 patented and unpatented mining claims, acquired by V. D. Williamson, of Spokane. Mine is developed and ore blocked out to 800 level. Large tonnage now available for shipment and milling. Is installing compressor and electric-light plants. Will sink from 800 level, and Brown tunnel now in 1600 ft. will be continued 2000 ft. to intersect vein at point 1600 ft. below apex. When this work is completed company intends to erect concentrator. Sagle camp is situated about six miles north of Blacktail, on Lake Pend Oreille.

KANSAS

J. C. CAMERON (Galena)—Has leased 40 north of Panama mines to Marshall, Moss & Kirkpatrick, who will open up ground and lease it out to miners and do custom work in mill located on land. They expect to run tailings until ground is ready for miners.

PANAMA (Galena)—Is busy on Connor land east of Galena. Has installed pump and will install boiler and outfit on 40-acre lease on Connor land in Cooper Hollow. There are number of shafts already in ore and company expects to commence taking out ore as soon as ground is drained.

OLD CYCLONE (Galena)—Transferred to G. W. Landreth & Co. through agency of J. Franklin Smith & Co. Mines have been in operation for some time and have been among best producers in district. New owners will remodel plant and install some modern machinery and operate mines on larger scale.

SUFFER LOSS BY CAVE-IN—Much damage was done by a large cave-in on the Land and Arthur land near Front St. and Galena Ave. Two companies lost heavily and were forced to cease operations. The Silver Coin Mining Co. lost nearly all its machinery, which went down with the dirt and waste. The Rohrbough Bros. were more fortunate. They saved their machinery and part of their shaft.

MICHIGAN

Copper

WINONA (Winona)—Will be working full crew and full blast by June 1. Underwatering proceeding rapidly.

SOUTH LAKE (Houghton)—Houghton shareholders are very much opposed to proposed consolidation with Algomah.

ALLOUEZ—(Allouez)—Will not show any loss in month's total copper output because of small accident last week. Rock tonnage is now above normal, making up for this difficulty.

ONONDAGA (Houghton)—Has resumed diamond drill explorations, following satisfactory results secured soon after organization of company. Drilling is in zone of formation which White Pine is operating.

ISLE ROYALE—(Houghton)—Is now furnishing rock for four heads, one at Franklin, one at Tamarack's little mill, and two at Point Mills plant. One head at rebuilding Isle Royale mill will be ready for operation about June 15.

OSCEOLA CONSOLIDATED (Osceola)—Cave-in of ground from surface to fifth levels between Shafts 1 and 2, South Kearsarge branch, did absolutely no underground damage. It was a fall of ground worked in early days of mine and had long been expected.

CALUMET & HECLA (Calumet)—Despite efforts of Manager MacNaughton miners at Calumet & Hecla continue to go ahead with plans for big Calumet celebration of "Dividend Day" June 12. That day concludes week's meeting of state encampment of the Knights Templars of Michigan. MacNaughton is most popular man in state today.

WHITE PINE (Outonegan)—Vein is widening at lower levels and mining problem is not as difficult as formerly. Shafts now are below 1100 ft. point on incline. At beginning shaft went down at an angle of 18° but later was straightened to 38°. It may be some time before there is another shipment of mineral, because of great difficulty in teaming from mine to loading dock. There have been long-continued rains and ordinarily difficult clay-mud road is almost impassable at this season.

Iron

CHAPIN (Iron Mountain)—This now valued at $2,574,602. Ore in stock is estimated to be worth $425,398. Cut in value of real property is considerable.

RICHMOND (Palmer)—Night force has been added here. Regular shipments are now being made from pit. Ore is being shipped by M. A. Hanna Co.

CASTILE (Bessemer)—Preparations being made to mine extension of Anvil orebody found in Eureka mine some months ago. Large electric-driven compressor and other machinery to be purchased. Anvil belongs to Newport Mining Co.

IMPERIAL (Michigamme)—Two No. 6 crushers have been removed from crusher house here. One is being installed at Lake mine at Ishpeming and other at Negaunee at Negaunee. Cleveland-Cliffs Iron Co. has decided to crush almost all of its ore. It is then more in demand by furnaces.

PEWABIC (Iron Mountain)—Part of force here has been laid off and working hours reduced. Most of good ore is exhausted; only low-grade material is now being mined. At one time the Pewabic was the richest mine on the Menominee range. Valuation of mine was reduced this week by state tax commission to $102,129, and stock pile to $134,760.

MONTANA

Deer Lodge County

WASHOE PLANT (Anaconda)—New acid plant put in commission May 17 and will start manufacture of sulphuric acid for use in leaching process. Construction work completed to point where operations can proceed, though not all Gay Lussac towers have been finished. Capacity of the plant is 100 tons of acid per day. Acid will be carried to leaching plant on hill in special tank cars.

Lewis & Clark County

BARNES KING—New mill of company's Piegan Gloster property near Marysville had power turned on May 16 for purpose of trying out new line. Not much can be done until shaft is unwatered which will be done with aid of electric pumps.

Missoula County

MAMMOTH MINING CO.—This company just incorporated at Wallace, Idaho, has acquired Lead King group of mines consisting of six claims, located 8 miles northeast of Bonita and 4 miles west of the well known Copper Cliff property in same mineral zone as Garnet and Clinton districts. Development consists of three shafts and several tunnels and open cuts. Orebodies average 25% lead and from 2 to 12 oz. in silver. Vein has been opened distance of 2000 ft.

Park County

BUFFALO-MONTANA (Cooke City)—Planning to ship 100 tons of ore per day during summer. Fifteen auto trucks and trailers have been ordered for hauling ore from Cooke to Gardiner on railroad. Company is taking advantage of recent permission of government to haul ore in autos through Yellowstone park, distance of 63 miles.

Silver Bow County

CORBIN COPPER (Butte)—Owner of Gambrinus claim is trying to sell. Gambrinus is favorably located and carries extension of several of Anaconda company veins, but it is undeveloped and it requires great deal of money to open property.

KING COPPER M. & R.—This Salt Lake corporation has acquired Isele lode mining claim in Summit Valley mining district and has filed its articles of corporation for $50,000, to do a general mining, milling and reduction business. Incorporators are P. S. Keogh et al. of Salt Lake, Utah.

EAST BUTTE (Butte)—Both mine and smeltery now in operation at normal capacity. During suspension one of furnaces was entirely rebuilt and capacity nearly doubled. About 500 men are employed in mine and smeltery. Considerable ore from several independent producers in Butte district being treated.

TIMBER BUTTE MILLING (Butte)—Mill partially closed down for two weeks started again at full capacity. During shut-down which was necessitated by temporary interruption in ore supply from Elm Orlu mine, all machinery in mill was overhauled and necessary repairs made so that plant is again in first-class condition.

BUTTE CENTRAL (Butte)—In suit against this company brought by members of the International Underwriters' Co., report favorable to defendants has been filed in supreme judicial court of Boston, Mass. Property in question is old Ophir mine in southern section of Butte district which in years past has yielded considerable quantities of high-grade silver ore.

BULLWHACKER COPPER (Butte)—Started operations on May 3 after long shut-down; has increased output of mine since opening of Pittsmont smeltery of East Butte mine. Car of ore per day is sent there in addition to from two to three cars a day which go to Washoe smeltery. In view of present high price of copper company decided on mining and shipping ore now and not to wait upon further experiments with leaching process installed at plant.

NEVADA

Esmeralda County

BLUE BULL-NEW GOLDFIELD SIMERONE (Goldfield)—Side-line agreement signed recently. Latter company has three-year lease on block of ground adjoining Simerone, owned by Blue Bull. New Goldfield Simerone gives Blue Bull privilege of working through its shaft, which is to be sunk to 400 level. Oreshoot 100 ft. long, assaying $60 to $100 per ton opened. Much development work on 250 level will be done.

ATLANTA (Goldfield)—Rumor that Merger company will not permit Atlanta company to operate through Merger shaft not taken seriously as Atlanta paid for sinking of shaft from 1330 to 1750 level and installed pumping plant. If necessary, however, Atlanta will install supplementary hoist at winze from 1400 level and work through Grizzly Bear shaft.

MERGER MINES CO. (Goldfield)—Demand by minority stockholders of 200,000 shares Jumbo Extension stock to withdraw suit and cease attack on validity of Velvet claim sale refused. Later report from Seattle states federal court has authorized receiver Johansen to institute suit in any United States court against Geo. Wingfield, Atlanta, Goldfield Consolidated, Jumbo Extension and Clark interests for recovery of Velvet claim, value of ores extracted and damages.

Eureka County

UNION MINES (Union)—Large tonnage zinc-lead-silver ore developed and milling plant will be built, according to statement of general manager Thatcher.

Humboldt County

MOREY vs. STAR PEAK MINING & LEASING CO. and WHITE (Winnemucca)—Suit for recovery of 100,250 shares Star Peak stock instituted.

NEW STRIKES AT WILLARD MADE RECENTLY, extending bounds of known mineralized area. On Sheepherder's Dream claim, one mile north of original Honey Bee strike, shoot 5 ft. wide, assaying $15 in gold opened. Rich strike made by Shea and Pitman south of Shepherder claim. Strikes also made on Trinidad, Enterprise and Ruth claims. Development of ore on Oddie lease continues; on Finlander group, vein opened by cuts every 40 ft. for length of 300 ft.; assays show $22 to $72 per ton.

Mineral County

THORNDYKE-BLEY (Sunland)—Mine and mill sold at sheriff's sale to Walter Trent, of Reno. Large tonnage ore developed in mine and on dumps. Property in Buena Vista mining district.

AURORA (Aurora)—First shipment of cyanide precipitate made recently by parcel post. Total value estimated at $58,000; representing mill run of less than one month. Precipitate will be refined at Goldfield Consolidated plant, Goldfield.

Nye County

TONOPAH SCHOOL OF MINES formally opened Monday, May 2, by Prof. E. R. Bennett. Enrollment of 20 already made. Classes will be held temporarily in old high-school building.

TONOPAH ORE PRODUCTION for week ended May 15 was 10,617 tons, estimated value $217,066 compared with 9871 tons week previous. Producers were: Tonopah Belmont, 3537; Tonopah Mining, 3050; Tonopah Extension, 1780; West End, 783; Jim Butler, 1050; Tonopah Merger, 258; North Star, 52; and Halifax, 107 tons.

TONOPAH EXTENSION (Tonopah)—New 40-leaf addition to filter presses being installed; mill capacity will be increased to 275 tons per day. Murray vein stope on 1170 level is 35 ft. wide and good grade.

Storey County

UNITED COMSTOCK PUMPING ASSOCIATION (Virginia)—Reidler pumps at C. & C. shaft in steady operation.

OVERMAN (Virginia)—On 1200 level the raise from east crosscut carried up 8 ft. to 50-ft. point. Top in quartz and porphyry.

SIERRA NEVADA (Virginia)—Jointly with Union Con. continued to alter and retimber winze station on south boundary line and prepare for installation of hoist.

UNION CON. (Virginia)—West crosscut on 2650 level extended 10 ft. making total length 645 ft. Face in porphyry, clay and quartz. Six tons ore sampling $10.26 per ton extracted.

MEXICAN (Virginia City)—Broke ore (and stored it) in north drift 123 ft. from northeast drift, 2300 level. Completed installation of ladders, platform, blower pipe and guides in winze from 2500 to 2700 level. Water cleared on 2700 level.

NEW MEXICO

Socorro County

TRI-BULLION SMELTING & DEVELOPMENT (Kelly)—Has succeeded in closing contract for resumption of operations with its immediate neighbor, Ozark Smelting & Mining Co., owned and operated by Sherwin-Williams Co., one of largest and strongest international paint manufacturing companies. Contract covers period of three years, and resumption of operations at properties, New Mexico, whereby above company is to both mine and treat ores upon royalty based upon current prices for spelter. Work was commenced on May 1.

UTAH

Beaver County

IN THE FORTUNA GOLD DISTRICT seven properties are doing work, the Fortuna, Gold Queen, Paymal, Golconda, Fortuna Gold, Mother Lode and Homestead. The Beaver Gold, on the east side of the valley, is to continue its 100-ft. shaft to the 300 level.

HORN SILVER (Frisco)—Survey shows new strike to be 180 ft. from King David lines, on two claims of which Horn Silver has taken lease, vein striking in that direction. Frank Clayton lease, expired Apr. 1, is stated to have netted between $10,000 and $15,000.

MOSCOW (Milford)—Electric hoist to be installed to replace one at present using distillate. Electrically driven compressor is in operation, furnishing air for old workings over ridge from new shaft. Hoisting is being done here at present by compressed air instead of by steam.

Juab County

TINTIC ORE SHIPMENTS for week ended May 14 totaled 147 cars, estimated 7350 tons valued at $180,000, compared with 149 cars week previous, heaviest weekly output in many months.

WEST TINTIC MINING (Tintic Junction)—This company has recently been incorporated to develop group of claims near the Scotia.

GEMINI (Eureka)—Electrically driven pumping plant to be overhauled, to permit of unwatering workings below 1600, present water level.

CHIEF CONSOLIDATED (Eureka)—Has located 18 claims in North Tintic, where it is proposed to do exploration work. Vacant ground also acquired in East Tintic where work will be done. Diamond drills will be used.

Salt Lake County

UTAH COPPER (Bingham)—One new unit is working on flotation at Magna mill.

UTAH APEX (Bingham)—Net profits for quarter ended Mar. 31 were $51,106. New body of shipping ore has recently been opened on 700 level. The bonded indebtedness has been reduced to $49,000.

COLUMBUS EXTENSION (Alta)—Stringer of ore carrying gray copper has been opened from raise above tunnel level in what is thought to be Flagstaff fissure. Main tunnel is being driven ahead for Toledo fissure, two shifts working with machine drills, but progress is slow, owing to necessity of timbering.

SECRET MINING & MILLING (Alta)—Owning claims in upper part of Little Cottonwood has increased capitalization from 300,000 to 600,000 shares. Arrangements have been made for a 20-yr. right-of-way through Albion tunnel, 3500 ft. long. Crosscut from this tunnel will enter Secret ground, after 800 ft. of work, and give depth of 1500 ft. Development will be started shortly.

WASATCH MINES (Alta)—Work to be started shortly on new drainage tunnel, which will be driven about 4000 ft. to drain Columbus Consolidated section of this property, 100 ft. below deepest workings. Tunnel will start in southwestern part of former Superior Alta ground, now belonging to Wasatch Mines. Timbering is being done in Flagstaff ground, where recent strike of 5 ft. of silver-lead ore was made. Drifting on oreshoot will be continued. Is thought to be continuation of faulted No. 5 orebody.

Summit County

SILVER KING COALITION (Park City)—A flotation plant is proposed in addition to present mill equipment.

CHILE

BRADEN (Rancagua)—During March, mill treated 80,304 tons of ore averaging 2.01% copper, producing 7043 tons of 15.66% concentrates from which 1261 tons of copper were realized.

AFRICA

Transvaal

GOLD OUTPUT IN APRIL is reported at 744,080 oz. fine, of which 717,225 oz. were from Witwatersrand and 26,855 oz. from outside districts. Total is 9855 oz. less than in March, but 60,203 oz. more than in April, 1914. For four months ended Apr. 30 total production was 2,648,692 oz. in 1914 and 2,889,220 oz. in 1915; an increase of 240,528 oz. this year. Total number of negro laborers employed in Transvaal mines at the end of April was 195,359, an increase of 1904 over March.

The Market Report

Metal Markets

NEW YORK—May 26

Copper was dull and weak, but at the close there seemed to be a good prospect of renewed demand. Tin was dull, uninteresting and stationary. Lead became decidedly stronger, and the leading producer advanced its price. Spelter experienced the craziest week that has ever been recorded up to this time.

Copper, Tin, Lead and Zinc

Copper—The lull in demand continued. The principal producers steadily maintained their asking price from 18¾@19c., regular terms. During the early part of our week of record, when copper was offered from several quarters at material concessions in price, no business was reported done among the principal offices. On Monday and Tuesday some sales, relatively small, were made at 18½c., regular terms. On Wednesday morning some sales were made at the same price, but later a new inquiry developed and the market was quoted stronger, although no business was reported consumated.

The Calumet & Hecla company is reported to be very well sold ahead at 23c. per pound.

Certain domestic consumers who have never used anything heretofore but Lake copper are now said to be considering the use of electrolytic.

Copper Exports from the United States for the week ended May 15 are reported by the Department of Commerce at 11,501,528 lb.; the chief items being 4,539,932 lb. to France, 3,569,890 lb. to England and 3,209,768 lb. to Italy. Imports for the week were 3,704,514 lb. metal and 8,866,485 lb. in ore and matte; 12,570,999 lb. in all, the larger part from Cuba.

Copper Sheets base price 24c. per lb. for hot rolled and 25c. for cold rolled. Usual extras charged and higher prices for small quantities. Copper wire, 20c. per lb. at mill, carload lots.

Visible Stocks of Copper in Europe May 15 were: Great Britain, 19.291; France, 2263; afloat from Chile, 1875; afloat from Australia, 4000; total, 27,429 long tons, an increase of 1065 tons over the Apr. 30 report.

Articles of dissolution have been filed with the Secretary of State at Trenton, N. J., by the United Metals Selling Co., which now exists only as a subsidiary of the Anaconda Copper Mining Co.

Tin—Practically nothing was done in this market. The price remains stationary. The deliveries both on the Atlantic and Pacific coasts are large this month, which naturally detracts from interest in the spot market.

Lead—A good inquiry developed from ammunition manufacturers, and on May 25 the A. S. & R. Co. advanced its price to 4.30c., New York. This took most of the other producers by surprise, relatively cheap lead having been offered in considerable tonnages in the St. Louis market right up to the eve of the advance. In the New York market, however, some comparatively small sales had previously been made at 4.25 and 4.30c.

Spelter—The spelter market during the last week of record was the craziest in the history of the metal. Transactions in ordinary brands, of which we had reports, aggregated 14,150 tons, besides which there were large transactions in the superior grades. The buying was mostly by ammunition manufacturers. These manufacturers have extraordinarily lucrative contracts, the profit from which renders the price paid for spelter almost immaterial. The chief thing in their minds appears to be to contract for all the spelter they are going to require in filling their ammunition orders. This has been reflected in the spelter markets of recent weeks, the bulk of the business having been done in contracts for delivery running from August to the end of the year. This condition was more pronounced during the last week of record than in any previous time. The producers have been for a long time well sold ahead, but as each month comes to an end their safety reserve becomes released and available for prompt delivery. Such supplies are peddled out at large premiums, and during the last week upward of 18½c. per lb. was realized for such in the latter part. However, the business for such deliveries was absolutely trifling in comparison with the bulk of the business. It is noteworthy that one large contract running into 1916 was made.

With the crazy market that we had last week, it may almost go without saying that prices were erratic. There were wide variations between sales from the same office, and among sales by different producers, who found it impossible to keep closely posted as to conditions. On Wednesday the business became much less in volume.

Toward the end of the week, sales of brass special spelter for June-July delivery were made at 22c. The price for intermediate spelter was 23@25c., according to grade and time of delivery. High-grade spelter was reported sold at 25c. and upward.

Many of the galvanizers are urging their customers to discontinue the use of galvanized steel. Two or three galvanizers have intimated that they were going to draw the spelter from their pots, and have asked for bids on the same.

DAILY PRICES OF METALS IN NEW YORK

May	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
20	4.7850	49¾	*18.40 @18.50	38	4.20 @4.25	4.10 @4.15	13.75 @15.25
21	4.7806	49¾	*18.30 @18.40	38	4.20 @4.25	4.10 @4.15	14.00 @15.50
22	4.7844	49¾	*18.25 @18.35	38	4.20 @4.30	4.12½ @4.17½	14.00 @16.00
24	4.7850	49¾	18.25 @18.35	38	4.20 @4.30	4.12½ @4.17½	15.50 @17.50
25	4.7844	49⅞	18.25 @18.35	38	4.30	4.17½ @4.22½	17.00 @18.50
26	4.7838	49¾	18.35 @18.55	38	4.30 @4.37½	4.17½ @4.22½	17.50 @19.00

*Nominal.

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

May	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'td	Spot	3 Mos.				
		£ per Ton	Cts. per Lb.					£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
20	23 9/16	75⅞	16.48	76⅞	....	160¾	160¾	20 1/16	4.36	70	15.21
21	23 9/16	75¼	16.35	76¼	....	162¼	162	20 1/16	4.36	71	15.43
22	23 9/16	....	....	....	....	....	....	....	....	....	....
24	....	....	....	....	....	....	....	....	....	....	....
25	23⅜	76	16.51	77	....	164	163¾	20 1/16	4.36	73	15.86
26	23 9/16	76¾	16.67	77¾	....	162	161½	20¼	4.40	73	15.86

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

This will not add greatly to the supply of spelter, but it is a straw showing how the present conditions are annihilating the galvanizing industry.

Zinc Sheets, base price $24 per 100 lb., f.o.b. Peru, Ill, less 8% discount. Usual extras charged.

Exports from Baltimore for the past week included 224,098 lb. spelter and 677,280 lb. zinc dross, all to Liverpool.

METAL EXPORTS AND IMPORTS

Exports and Imports of Metals other than iron and steel in the United States, three months ended Mar. 31:

	Exports		Imports	
	1914	1915	1914	1915
Copper, long tons	113,726	81,096	42,293	25,322
Tin, long tons	172	185	11,845	8,787
Lead, short tons	1,775	24,554	5,147	19,129
Zinc, short tons	421	41,681	250	241
Nickel, lb.	7,444,694	8,077,564	10,995,349	10,376,456
Antimony, lb.	.....	109,296	3,724,804	4,554,802
Aluminum, lb.	.....	17,555	3,982,572	2,618,992
Quicksilver, lb.	2,886	103,303	.....	.....
Platinum, oz.	5,293	.....	19,939	4,216

Copper, lead, nickel and antimony include metallic contents of ore, matte, etc. Exports include reëxports of foreign material. Imports of zinc ore for the three months this year were 14,909 tons, estimated to contain 10,619,466 lb. zinc. No exports of domestic ore were reported. Exports of aluminum in manufactured forms were valued at $275,927 in 1914, and $1,127,337 this year.

Other Metals

NEW YORK—May 26

Aluminum has suddenly developed new activity and a sharp advance in price. Spot lots have been in demand and are now quoted at 24@26c. per lb. for No. 1 ingots. The stock of imported metal here is small. The chief producer is selling on contract as usual, but is not quoting on outside business just now—**Antimony** is very dull. In the absence of business quotations are largely nominal at 34@35c. per lb. for ordinary brands and 40c. per lb. for Cookson's.—**Nickel** is steady and unchanged. Ordinary forms are 40@45c. per lb., according to size and terms of order. Electrolytic, 3c. per lb. higher.—**Quicksilver** is firm, and supplies are only moderate. The Italian Government has placed an embargo on all exports from Italy. New York price is $74 per flask of 75 lb. for large lots, with smaller orders $75@80 per flask. San Francisco price is telegraphed at $65@67.50 per flask, with some dealers holding at $75, supplies being short. London price £11 15s. per flask, with £11 23s. 6d. named from second hands.

Minor Metals—Current sales of **Bismuth** are at $2.75@3 per lb. New York. The London price is quoted at 10s., or $2.40 per lb. there.—**Cadmium** is quoted at 6s., or $1.44 per lb. in London; $1.50 per lb., New York.—**Tellurium** is reported sold at 80s., or $19.20, per lb. in London.—**Selenium** is quoted at $2@3 per lb. New York for larger quantities; $4.50@5 for retail lots. Exports from Baltimore for the past week included 1592 lb. selenium to Rotterdam.

Gold, Silver and Platinum

NEW YORK—May 26

Gold imports in Great Britain four months ended Apr. 30 were £4,280,780; exports, £3,135,461; excess of imports, £1,145,319, against £2,841,656 last year.

Silver the past week has remained almost stationary, the price being for the most time 23 $\frac{7}{16}$d. There are some accumulations of silver, sellers feeling that the price is too low and that any large inquiry ought to advance the price materially.

Shipments of silver from London to the East Jan. 1 to May 13, as reported by Messrs Pixley & Abell:

	1914	1915	Decrease
India	£2,772,000	£2,171,000	£601,000
China	40,000	5,000	35,000
Total	£2,812,000	£2,176,000	£636,000

China banks have been selling some silver in Bombay, and are said to be ready to sell more.

Silver imports into Great Britain four months ended Apr. 30 are valued at £3,382,534; exports, £3,175,124; excess of imports, £207,410, which compares with an excess of exports of £1,294,023 last year.

Platinum here remains quiet with little doing and no change in prices. Dealers quote $38@39 per oz. for refined platinum; $42@46 per oz. for hard metal, according to grade.

Late advices from Russia put the total production of platinum in that country in 1914 at 156,775 oz., which is a decrease of 16,867 oz. from 1913. It is understood that about 46,000 oz. of crude metal is held by the banks at Ekaterinburg nad Petrograd, on which advances have been made to the producers. Notwithstanding the embargo there is little difficulty in securing permits for export to friendly countries.

Zinc and Lead Ore Markets

JOPLIN, MO.—May 22

Blende, high price, $79; assay base per ton 60% zinc, premium ore $75.50; medium grades $73@70; lower grades down to $62. Calamine, base per ton 40% zinc, $50@44; average, all grades of zinc, $68.94 per ton. Lead, high price $54.50, base $51@52 per ton of 80% metal content; average, all grades of lead, $50.36 per ton.

SHIPMENTS WEEK ENDED MAY 22

	Blende	Calamine	Lead	Values
Totals this week..	10,959,220	713,630	2,063,540	$454,320
Totals this year...	224,295,430	19,854,320	33,539,410	8,099,690

Blende value, the week, $386,370; 21 weeks, $6,915,790.
Calamine value, the week, $16,000; 21 weeks, $364,810.
Lead value, the week, $51,950; 21 weeks, $819,090.

First shipments were made this week to the Cherokee Zinc Co., at Bruce, Kan., for the firing of four blocks by June 1. Also the Kirk plant at Iola. The name of the company operating the North Pittsburg smeltery is the Joplin Ore & Spelter Co. Buyers worked industriously and quietly all week purchasing ore, and it is estimated over 8000 tons were bought for next week's delivery.

PLATTEVILLE, WIS.—May 22

The base price paid this week for 60% zinc ore was $64@66 per ton. The base price paid for 80% lead ore was $51 per ton.

SHIPMENTS WEEK ENDED MAY 22

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	2,569,760	372,750	767,500
Year	72,204,860	2,718,740	8,919,450

Shipped during week to separating plants, 2,952,190 lb. zinc ore.

Iron Trade Review

NEW YORK—May 26

The iron and steel trades continue to show improvement. The foreign orders received, while somewhat exaggerated by general rumor, are still very considerable, while domestic business is manifestly increasing. An encouraging lift has been given by the orders placed by the Pennsylvania R.R., and other railroads are likely to follow suit.

Structural steel business improves slowly as large building projects seem to hold back. There is, however, a good demand for smaller building material and jobbers report an encouraging demand for bars, nails and other small material. Operation of the mills generally is pretty well up to 75% of capacity and is increasing rather than diminishing.

Pig iron is quiet, but fairly firm, and the rate of production is increasing. Sales of foundry iron have been rather light, but the demand for basic is increasing.

Exports from Baltimore for the week included 384,366 lb. bars, 1,821,108 lb. wire rods, 108,510 lb. skelp steel and 4,316,150 lb. steel billets, all to Liverpool.

Imports at Baltimore for the week included 2250 tons ferromanganese from Great Britain and 3550 tons manganese ore from Brazil.

United States Foreign Trade in Iron and Steel and manufactures thereof, three months ended Mar. 31, as valued by the Department of Commerce:

	1914	1915	Changes
Exports	$53,777,795	$55,509,677	I. $1,731,882
Imports	7,412,747	4,538,047	D. 2,874,700
Excess, exports	$46,365,048	$50,971,630	I. $4,606,582

The larger increases in exports this year were in billets, bars and wire.

PITTSBURGH—May 25

The iron and steel situation shows no material change, except in detail. Steel bookings are about the same as formerly, but a larger proportion is furnished by the export demand, both direct and indirect. The demand for steel rounds for shrapnel and rifles to be made in this country is very heavy. Export barb wire is in less demand, but rods, plain wire and nails show an increase more than making up the difference.

The steel mills have received scarcely any actual orders as yet from car builders for use on the 14,000 freight cars lately ordered by the Pennsylvania, many details as to equipment having to be settled before the formal contracts are placed.

Italy's entrance into the war will probably be followed by increased demand for coal, pig iron and scrap for that country, and there may be demand for war munitions. Italian emigration on a large scale would not materially affect the supply of labor for coke works, blast furnaces or steel works, but might possibly affect the labor supply for construction work, which consumes steel.

Steel prices are being well held in the main. Merchant bars are strong, while shapes are steady and plates continue weak. Wire products are on the basis of 1.55c. for nails, with some shading. Galvanized sheets are advancing sharply, owing to the spelter famine. The leading interest is selling in a limited way on the basis of 3.60c. for 28 gage, but several independents are quoting 4.00c., and still higher prices are predicted. Substitutes are being much discussed, but it is well to recall that in 1901, during the Amalgamated Association's strike against the Steel Corporation, galvanized sheets sold at 5.20c. for 28 gage.

Pig Iron—The market continues rather quiet, but with a firmer undertone. Prices can scarcely go lower, while they could easily advance sharply if once the start were made, as this would undoubtedly bring buyers into the market with a rush. We quote: Bessemer, $13.60; basic, $12.50@12.65; No. 2 foundry, $12.75@13; gray forge, $12.50@12.75; malleable, $12.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—The English makers recently withdrew their $88 price and now quote $100 at seaboard. Small prompt lots are bringing a trifle less. Consumers are well covered on contracts and are interested chiefly in deliveries, which are gradually increasing.

Steel—Billet and sheet bar deliveries are heavy and demand is considered good, but consumers are so well covered by contracts that market transactions are exceptional. We quote billets at $18.50@19 and sheet bars at $19@19.50, f.o.b. maker's mill, Youngstown, and 50c. higher at maker's mill, Pittsburgh. Rods are $25, Pittsburgh, and firm at that price on account of the continued export demand.

FOREIGN IRON NOTES

The German Iron & Steel Union reports steel production in March at 1,098,273 metric tons, being 152,080 tons more than in February. For the three months ended Mar. 31 the total make of steel was, in metric tons:

	Basic	Acid	Total
Converter	1,525,434	35,716	1,561,150
Openhearth	1,237,571	48,003	1,285,574
Direct castings	84,802	25,890	110,692
Crucible	.....	25,222	25,222
Electric	.....	25,616	25,616
Total	2,847,807	160,447	3,008,254
Total, 1914	4,557,407	189,155	4,746,552

The total decrease from 1914 was 1,738,198 tons, or 38.1%. There were 233 steel works in operation this year.

IRON ORE

Imports and exports of iron ore in the United States three months ended Mar. 31, in long tons:

	1914	1915	Changes
Imports	282,927	242,461	D. 40,466
Exports	14,255	6,521	D. 7,734

Of the imports this year 159,875 tons were from Cuba, 31,043 tons from Sweden and 5193 tons from Spain. Exports were chiefly to Canada.

Imports of manganese ore for the three months were 58,147 tons in 1914, and 10,274 in 1915; decrease, 47,873 tons.

The Interstate Commerce Commission has filed its decision in the application of the Newport Mining Co. and others, who complained of the rate charged from mines on the Marquette, Menominee and Gogebic ranges to the Lake ports of Ashland, Marquette and Escanaba. The rate was formerly 40c. per ton for ore placed on board vessels; in January, 1913, the carriers filed supplementary tariffs separating their charge on ore traffic and applying a 5c. per gross ton additional charge for dock service, but keeping in effect the old rate of 40c. which then applied only for the service of assembling and line haul up to the dockyard. The effect was practically to increase the rate to 45c. The Interstate Commission holds that the rate of 45c. is not excessive, and can stand. It is further held that the system of grouping all the mines on one range under a blanket rate to the nearest port does not constitute a discrimination.

British Iron Ore Imports four months ended Apr. 30 were 2,070,224 long tons in 1914, and 1,881,449 in 1915; decrease this year 188,775 tons.

Statistics gathered by the "Marine Review" from the Lake Erie ports show that the amount of ore on Lake Erie docks on May 1 was 6,092,303 gross tons, against 5,920,157 tons in 1914, an increase of 172,146 tons. The total rail shipments from Lake Erie ports to furnaces during the winter season (Dec. 1 to May 1) aggregate 2,315,602 tons. Adding these winter shipments to 22,914,887 tons, the amount shipped to furnaces during the navigation season of 1914, gives 25,230,489 tons as the entire consumption of ore from Lake Erie ports during the year ended May 1, 1915, against 39,089,319 tons for the previous year.

Of the Lake ore shipments in April only 136,224 tons, or 27%, went to Lake Erie ports.

SAULT STE. MARIE CANAL

The total tonnage passing through the Sault Ste. Marie canals in April was: East bound, 1,090,077; west bound, 344,658; total, 1,434,735 short tons, which compares with 774,520 tons in April, 1914, and 1,905,555 tons in 1913. The number of vessel passages this year was 634, showing an average cargo of 2263 tons. The mineral freights included in the total were: Anthracite, 130,111 tons; bituminous coal, 149,455; iron ore 411,845; manufactured iron, 8580; copper, 5749 tons; salt, 50,937 bbl. The American canal opened Apr. 17; the Canadian canal Apr. 13, four days earlier.

COKE

Connellsville—The furnace coke market continues very dull. Prompt is $1.50, contract to July 1 about $1.60 and contract to Jan. 1 about $1.75, with scarcely any negotiating. Foundry coke is more active, both for prompt and for contract. Prompt brings $2@2.40 according to grade. Contracts are usually for the twelvemonth beginning July 1, the regular price for recognized standard brands being $2.40, with less-known brands bringing somewhat less.

Coal and Coke Tonnage of Pennsylvania R.R. lines East of Pittsburgh and Erie four months ended April 30, in short tons:

	1914	1915	Changes
Anthracite	3,705,800	3,607,419	D. 98,381
Bituminous	14,967,184	13,203,746	D. 1,763,438
Coke	3,593,030	3,136.262	D. 456,768
Total	22,266,014	19,917,427	D. 2,318,587

The total decrease this year was 10.4%. April was the best month in 1915, the total decrease being only 80,786 tons, or 1.5%, as compared with April last year.

Foreign Fuel Trade of the United States three months ended Mar. 31, as reported by the Department of Commerce in long tons:

	Exports		Imports	
	1914	1915	1914	1915
Anthracite	567,659	495,734	123	18
Bituminous	2,708,681	1,910,887	350,302	377,476
Coke	206,868	161,457	22,328	11,627
Bunker coal	1,787,123	1,609,894	.....	.....
Total	5,270,331	4,177,972	372,753	389,121

The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. The greater part of the trade, both imports and exports is with Canada.

Chemicals

NEW YORK—May 26

The general market is moderately active, and less disturbed than it has been for some time.

Arsenic—The market continues slow but generally steady. Quotations continue around $4 per 100 lb. for both spot and futures.

Copper Sulphate—Business is fair and prices are steady. Quotations are $7 per 100 lb. for carload lots and $7.25 per 100 lb. for smaller parcels.

The Nichols Chemical Co. gives notice that from June 1 the sale of sulphate of copper manufactured by the company will be handled exclusively by the General Chemical Co., as sole selling agent for North America. All inquiries and orders should be directed to the nearest office of the General Chemical Co. from that date.

Nitrate of Soda—Business is good but still a little irregular. Prices are firm and quotations continue about 2.30c. per lb. for all positions this year.

Imports and Exports of Chemicals in the United States, three months ended Mar. 31, in pounds, except for other soda salts of which only values are given:

	Imports		Exports	
	1914	1915	1914	1915
Arsenic	1,299,300	1,538,763	.....	660
Bleach	12,178,005	9,507,379	8,600	432
Potash salts	9,765,710	11,480,543	258,872	190,938
Acetate of lime	.....	.....	14,340,333	4,811,267
Calcium carbide	.....	.....	9,691,194	10,563,148
Sodium cyanide	.....	3,580,488	.....	1,164,339
Soda salts, value	$179,427	$232,922	$1,886	$9,085

Exports include reëxports of foreign material. Potash salts do not include the crude salts used in fertilizer manufacture.

Assessments

Company	Delinqe	Sale	Amt.
Advance, Mont	May 1	June 1	$0.005
Argenta, Ida	May 10	June 10	0.001
Belcher, Nev	May 15	June 8	0.15
Best & Belcher, Nev., (post.)	June 14	July 8	0.05
Caledonia, Nev	May 11	June 1	0.05
Cash Boy, Nev	May 17	June 17	0.01
Cedar Creek, Ida	May 5	June 5	0.005
Contact Copper, Mich	May 15	.....	0.50
Crown Point, Nev., (post.)	June 16	July 8	0.15
Diam'field Black Butte, Nev.	Apr. 30	June 3	0.01
Duluth, Ida	June 5	July 8	0.001
Emerald, Utah (three instal.)	.....	June 9	0.01
Exchequer, Nev	May 11	June 1	0.03
Hancock Cons., Mich	Sept. 1	.....	1.00
Hancock Cons., Mich	Jan. 3	.....	1.00
Houghton, Mich	May 25	.....	1.00
Idaho-Nevada, Ida	May 10	June 5	0.002
Idora, Ida	June 3	July 2	0.005
Laclede, Ida	May 24	June 14	0.003
Majestic-Idol, Nev	Dec. 15	July 20	0.005
Moonlight, Ida	.....	June 5	0.005
Nevada-Douglas, Nev	Apr. 24	June 10	0.10
New Arcadian, Mich	June 1	.....	0.50
New Arcadian, Mich	Dec. 1	.....	0.50
New Hope, Ida	May 5	June 2	0.002
North Lake, Mich	.....	June 15	1.00
O. K. Silver, Utah	May 3	June 5	0.0025
Ophir, Nev	June 4	June 25	0.05
Overman, Nev	May 19	June 8	0.05
Raymond-Illinois, Utah	May 24	June 9	0.005
Raven, Ida	May 15	June 14	0.0006
Royal, Ida	June 1	July 6	0.0015
Samson, Ida (post.)	.....	June 3	0.002
Selma, Utah	May 29	June 16	0.005
Sierra Nevada, Nev	May 10	June 1	0.05
Silver Moon, Ida	May 18	June 18	0.005
Silver Mountain, Ida	May 15	June 15	0.002
Silver Pick, Nev	June 5	July 12	0.01
Tarbox, Ida	Apr. 26	May 28	0.0025
Tintic Standard, Utah	.....	June 1	0.005
Treasure, Calif	.....	.....	0.05
United Tintic, Utah	May 25	June 15	0.005
Utah United, Utah	May 20	June 10	0.01
Wisconsin, Ida	May 15	June 15	0.003
Yellow Jacket, Nev., (post.)	June 14	July 8	0.15

Stock Quotations

Sales at auction on Wednesday, May 19, in New York, included: 160 shares Silver Link Mining Co., $10 lot; 7500 shares Horn Silver Mining Co., $475 lot.

COLO. SPRINGS May 25		SALT LAKE May 25	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.04½	Beck Tunnel	.04
Cripple Cr'k Con	.01½	Black Jack	.06½
C. K. & N	.03½	Colorado Mining	.10
Doctor Jack Pot	.10½	Crown Point	.01
Elkton Con	.42	Daly-Judge	5.25
El Paso	1.03	Gold Chain	.10
Findlay	.04	Grand Central	.50
Gold Dollar	.02½	Iron Blossom	.71
Gold Sovereign	.04½	Little Bell	.15
Golden Cycle	1.70	Lower Mammoth	.04
Isabella	.18½	Mason Valley	2.00
Jack Pot	.06½	May Day	.15½
Jennie Sample	‡.02	Opohongo	.01½
Jerry Johnson	.04	Prince Con	.40½
Lexington	‡.008	Seven Troughs	.01½
Mary McKinney	.37	Silver King Coal'n	3.05
Pharmacist	.01½	Silver King Con	1.87½
Portland	1.40	Sioux Con	.02
Raven B. H	.03	Uncle Sam	.04½
Vindicator	1.64	Yankee	.02

TORONTO May 25			
Bailey	.02	Dome Exten	.08½
Coniagas	‡.04½	Foley O'Brien	.30
Peterson Lake	.24	Hollinger	25.00
Right of Way	.03½	Imperial	.06½
Seneca Superior	1.25	Jupiter	.10
Silver Queen	.01½	McIntyre	.42
T. & Hudson Bay	20.00	Pearl Lake	.01
Timiskaming	.34	Porcu. Crown	.80
Wettlaufer-Lor	.04	Preston E. D	.02
Big Dome	14.25	Rea	‡.10

SAN FRANCISCO May 25			
Comstock Stocks		Misc. Nev. & Ca.	
Alta	‡.04	Belmont	4.30
Andes	.05	Jim Butler	.81
Belcher	‡.13	Lone Star	.07
Best & Belcher	.05	MacNamara	.03
Caledonia	.20	Midway	.16
Challenge Con	‡.06	Mont.-Tonopah	.33
Confidence	.08	North Star	.16
Con. Virginia	.10	Rescue Eula	.11
Gould & Curry	.02	West End Con	.74
Hale & Norcross	.03	Atlanta	.34
Julia	‡.01	Booth	.55
Mexican	.32	C.O.D. Con	.04
Occidental	.79	Comb. Frac	.10
Ophir	.07	Jumbo Extension	1.52½
Overman	.07	Pitts.-Silver Peak	.12
Potosi	‡.01	Round Mountain	.41
Savage	.02	Sandstorm Kendall	.08½
Sierra Nevada	.08	Silver Pick	.08
Union Con	.16	Central Eureka	.14
Yellow Jacket	.30	So. Eureka	‡2.25

N. Y. EXCH. May 25		BOSTON EXCH May 25	
Name of Comp.	Clg.	Name of Comp.	Clg.
Amalgamated	65¾	Adventure	3
Am.Sm.&Ref.,com	65¾	Ahmeek	380
Am. Sm. & Ref., pf.	102¾	Alaska Gold M	35
Am. Sm. Sec., pf. B.	‡80	Algomah	3
Anaconda	31¾	Allouez	54½
Batopilas Min	1½	Am. Zinc	46¾
Bethlehem Steel	139	Ariz. Com., ctfs	7¾
Bethlehem Steel, pf.	112	Bonanza	.35
Chino	44¾	Butte-Ballaklava	3
Colo. Fuel & Iron	30	Butte & Superior	70¾
Federal M. & S., pf.	28½	Calumet & Ariz	67½
Great Nor., ore., ctf.	31½	Calumet & Hecla	585
Guggen. Exp	59¾	Centennial	18¾
Homestake	117½	Cliff	1½
Inspiration Con	29½	Copper Range	51¾
Mex. Petroleum	69	Daly West	3
Miami Copper	25	East Butte	11½
Nat'l Lead, com	60¾	Franklin	10
National Lead, pf	108½	Granby	81
Nev. Consol	14¾	Hancock	21½
Ontario Min	3	Hedley	28
Quicksilver, pf	.75	Helvetia	.70
Ray Con	23½	Indiana	6½
Republic I&S, com	28¾	Island Cr'k, com	43
Republic I&S, pf	84½	Island Cr'k, pfd	88
SlossSheffi'd, com	33	Isle Royale	27½
Tennessee Copper	33½	Keweenaw	2¾
Utah Copper	65	Lake	13½
U. S. Steel, com	54¾	La Salle	6½
U. S. Steel, pf	106¾	Mass	14½
		Mayflower	5
		Michigan	1½
		Mohawk	72½
		New Arcadian	9½
		North Butte	31¾
		North Lake	2¾
		Ojibway	2¾
		Old Colony	4½
		Old Dominion	53½
		Osceola	80½
		Quincy	87¾
		Santa Fe	2¾
		Shannon	8¾
		Shattuck-Ariz	26½
		Superior	29
		Superior & Bost	3¾
		Tamarack	35
		Trinity	5¾
		Tuolumne	.40
		U. S. Smelting	37
		U. S. Smelt'g, pf	45
		Utah Apex	2¾
		Utah Con	12
		Victoria	3
		Winona	4
		Wolverine	57
		Wyandot	1¾

N. Y. CURB May 25	
Name of Comp.	Clg.
Alaska Juneau, w.i	13½
Alta Con	.88
Beaver Con	.35
Big Four	.07
Blue Bell	.03
Braden Copper	7½
Buffalo Mines	⅛
Can. Cop. Corpn	‡1 1/16
Can. G. & S	.03½
Caribou	.48
Cashboy	.09
Chambers Ferland	.17
Con. Ariz. Sm	.75
Con. Coppermines	‡1⅛
Davis-Daly	.99
Diam'field-Daisy	.07
Dia. Black B	.04
Florence	.54
Goldfield Con	1½
Goldfield Merger	.25
Greene Cananea	28
Kerr Lake	4¾
La Rose	.56½
McKinley-Dar-Sa	.28
Mines of Am	2¼
Nevada Hills	.23
New Utah Bingham	2
Nipissing Mines	5¼
Ohio Copper	.25
Oro	.08½
South Utah	‡⅛
Stand'd Oil of N.J.	396
Standard S. L	1½
Stewart	1¾
Tonopah	7½
Tonopah Ex	3½
Tonopah Merger	.38
Tribullion	⅜
Tularosa	.18¾
West End Ex	.04
Yukon Gold	2¼

BOSTON CURB May 25	
Name of Comp.	Bid.
Alvarado	.65
Bingham Mines	6
Boston Ely	.32
Butte & Lon'n Dev	.17
Calaveras	1¾
Calumet-Corbin	.10
Chief Con	.78
Corbin	.90
Cortez	.20
Crown Reserve	.75
Eagle & Blue Bell	1 1/16
First Nat. Cop	2 1/16
Houghton Copper	4½
Iron Cap Cop., pf	5
Majestic	.53
Mexican Metals	.15
Nevada-Douglas	.65
New Baltic	3½
Oneco	1⅛
Raven Copper	.10
Smokey Dev	.30
So. Lake	6½
Tonopah Victor	.31
Trethewey	.14
United Verde Ext	4½

LONDON May 14	
Alaska Tre'dwell	£7 7s 6d
Cam & Motor	0 15 3
Camp Bird	0 6 3
El Oro	0 8 0
Esperanza	0 8 3
Mexico Mines	3 17 6
Oroville	0 12 3
Santa Gert'dis	0 7 6
Tomboy	1 4 3
Tough Oakes	0 14 6

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.493	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	.....	27.825	26.704	.....
June	58.990	56.471	.....	27.199	25.948	.....
July	58.721	54.678	.....	27.074	25.219	.....
August	59.293	54.344	.....	27.335	25.979	.....
September	60.640	53.290	.....	27.986	24.260	.....
October	60.793	50.654	.....	28.083	23.199	.....
November	58.995	49.082	.....	27.263	22.703	.....
December	57.760	49.375	.....	26.720	22.900	.....
Year	59.791	54.811	.....	27.576	25.314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.49'	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.996	.....	63.182	.....	67.786	.....
June	13.603	.....	61.336	.....	66.274	.....
July	13.223	.....	60.540	.....	64.955	.....
August	*	.....	‡	.....	‡	.....
September	*	.....	‡	.....	‡	.....
October	*	.....	‡	.....	‡	.....
November	11.739	.....	53.227	.....	*	.....
December	12.801	.....	56.841	.....	*	.....
Year	.....	.....	.....	.....	.....	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	.....	150.702	.....
June	30.577	.....	138.321	.....
July	31.707	.....	142.517	.....
August	*	.....	‡	.....
September	32.675	.....	‡	.....
October	30.284	.....	‡	.....
November	33.304	.....	1?9.391	.....
December	33.601	.....	147.102	.....
Av. year	34.301	.....	.....	.....

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	.....	3.808	.....	18.503	.....
June	3.900	.....	3.810	.....	19.411	.....
July	3.891	.....	3.738	.....	19.051	.....
August	3.877	.....	3.715	.....	‡	.....
September	3.828	.....	3.658	.....	‡	.....
October	3.528	.....	3.384	.....	‡	.....
November	3.683	.....	3.585	.....	18.500	.....
December	3.800	.....	3.662	.....	19.097	.....
Year	3.862	.....	3.737	.....	.....	.....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	.....	4.924	.....	21.393	.....
June	5.000	.....	4.850	.....	21.345	.....
July	4.920	.....	4.770	.....	21.568	.....
August	5.568	.....	5.418	.....	‡	.....
September	5.380	.....	5.230	.....	‡	.....
October	4.909	.....	4.750	.....	‡	.....
November	5.112	.....	4.962	.....	25.016	.....
December	5.592	.....	5.430	.....	27.369	.....
Year	5.213	.....	5.061	.....	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported. ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	.....	13.90	.....	14.27	.....
June	14.90	.....	13.90	.....	13.96	.....
July	14.90	.....	13.90	.....	13.90	.....
August	14.90	.....	13.90	.....	14.08	.....
September	14.90	.....	13.90	.....	14.03	.....
October	14.84	.....	13.75	.....	13.97	.....
November	14.59	.....	13.43	.....	13.83	.....
December	14.70	.....	13.45	.....	13.83	.....
Year	$14.88	.....	$13.78	.....	$14.01	.....